# IMPROVED METHODS AND FACILITIES FOR COMMERCIAL CATTLE FEEDLOTS

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Growth Through Agricultural Progress

# PREFACE

The Agricultural Marketing Service, through its research program, makes recommendations concerning ways to increase marketing efficiency. One area of this broad program deals with layouts, facilities, equipment, and work methods for handling and marketing livestock and meat.

The commercial cattle feedlot business has grown rapidly in recent years and has become an important part of the livestock marketing system. Because of the relatively rapid growth of commercial cattle feedlots, many do not have the most efficient facilities for handling and feeding cattle and calves.

This report provides data and guidelines for use in designing layouts for commercial cattle feedlots of various sizes. It also provides data on the relative efficiency of different methods and equipment used in feeding cattle.

Acknowledgment is made to the feedlot operators who made their facilities available for study.

The study was conducted under the general supervision of George E. Turner, marketing research analyst, Transportation and Facilities Research Division, Agricultural Marketing Service.

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# SUMMARY

Improved layouts, equipment, and work methods can reduce costs for typical feedlots with capacities for 1,000, 5,000, and 10,000 cattle. The cost reductions occur in both labor and equipment and are due primarily to shorter driving distances in handling cattle and shorter transporting distances for vehicles. Costs for performing feedlot operations on typical layouts were based on studies of all operations on 14 feedlots, in addition to specific operations on 8 others. Costs were computed for improved layouts.

The cost for performing feedlot operations on a feedlot with a capacity for 1,000 cattle with a typical layout was $4.60 per head, compared with $4.17 with an improved layout. The cost reduction is 43 cents per head, with labor accounting for 19 cents of the reduction, and equipment 24 cents. The annual reduction would be $1,290 for a feedlot of this size.

The typical feedlot with a capacity for 5,000 cattle incurred a per-head feeding cost of $2.84, compared with $2.67 with an improved layout. The cost reduction is 17 cents per head: Labor is reduced 13 cents and equipment 4 cents. Annually, the reduction in labor and equipment cost is $2,550.

The costs of performing feedlot operations on a typical feedlot with a capacity for 10,000 cattle were $2.52, compared with $2.25 for an improved layout. Costs are reduced 27 cents per head, with labor accounting for 21 cents, and equipment 6 cents. This is a reduction of $8,100 per year for a feedlot of this size.

Labor and equipment costs for the typical and improved layouts were computed for each major operation: Receiving cattle, preparing feed orders, feeding cattle, daily inspection, care of sick or injured cattle, mounding manure, loading out cattle, and cleaning pens. A reduction in cost is incurred with the improved layout in all operations except care of sick or injured cattle and mounding manure. These costs are the same with the typical and improved layouts. The feeding operation is the most expensive and the one in which the most savings can be made.

Three methods were used in the feeding operation. Computed labor and equipment requirements and costs indicated that feedlots with a capacity for 1,000 to 4,000 cattle should use the self-mixing self-unloading truck method; feedlots with a capacity for 5,000 to 7,000 cattle should use the mixing-mill (mill capacity 40,000 pounds per hour) and self-unloading truck method; and feedlots with a capacity for 8,000 to 10,000 cattle should use the mixing-mill (mill capacity 75,000 pounds per hour) and self-unloading truck method.

Layouts are suggested for feedlots with a capacity for 1,000, 5,000, and 10,000 cattle. The major components of the suggested layouts are: Receiving and loading-out facilities, pen facilities, alleys, feeding facilities, equipment barn, fencing, watering facilities, management's office, parking area, and other facilities such as windbreaks and pen shades. The layouts show the arrangement of the various components for minimum travel distances for cattle, workers, and vehicles.

The proposed feedlot with a capacity for 1,000 head occupies 7.7 acres. It provides pens of proper size for feeding lots of 25, 50, and 100 cattle. The feeding facilities suggested for this feedlot permit the use of the self-mixing self-unloading truck method for feeding cattle. The suggested feedlot with a capacity for 5,000 head occupies 35 acres. It provides pens for feeding lots of 25, 50, 100, 200, and 300 head. The feeding facilities suggested for this feedlot permit the use of the mixing mill (mill capacity 40,000 pounds per hour) self-unloading truck method in feeding cattle. The proposed feedlot with a capacity for 10,000 head occupies 67 acres. It provides pens for feeding lots of 50, 100, 200, 300, 400, and 500 cattle. The feeding facilities suggested permit the use of the mixing-mill (mill capacity 75,000 pounds per hour) self-unloading truck method in feeding cattle. Each layout provides for future expansion, without disrupting the flow of cattle or affecting the efficiency of performance of feedlot operations.

# IMPROVED METHODS AND FACILITIES FOR COMMERCIAL CATTLE FEEDLOTS

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## INTRODUCTION

Finishing cattle in feedlots is a comparatively new business and one that has made tremendous growth during the past two decades. On January 1, 1961, 7,583,000 cattle and calves were reported on feed in feedlots in 26 States, compared to 4,411,000 on the same date in 1945. In a 15-year period, the number of cattle on feed in feedlots increased about 72 percent. Current indications are that the number of cattle finished in feedlots will continue to increase.

Cattle and calves are finished in two types of feedlots—farm feedlots and commercial feedlots. A farm feedlot is a business where the farmer-operator feeds his own cattle. It usually comprises only one enterprise of the total farm operations. The number of cattle and calves finished in a farm feedlot varies widely, ranging from one head to several hundred—and in a few instances more than a thousand. The commercial cattle feedlot is a business that provides facilities and feed, and hires labor to feed cattle for others on a custom basis. Most commercial feedlots are privately owned—the ownership being vested in an individual, a partnership, or a corporation with a small number of stockholders. A few commercial feedlots operate as cooperatives. The number of cattle and calves finished on feedlots of this type ranges from several hundred to several thousand head.

This study is limited to commercial feedlots. Many of the commercial feedlots are located in the western section of the country. However, they have gradually spread and are now reported in practically all sections of the country. In many instances commercial feedlots have developed as an integral part of the livestock marketing system. For illustration, many terminal yards and livestock auction markets now operate commercial feedlots in conjunction with their livestock market operations. Commercial feedlots are often closely tied in with slaughtering plants and many feedlots have an informal or formal agreement with a slaughtering plant. Most commercial feedlots are visited frequently by packer buyers and in many instances prices are determined on the feedlot

Because of their relatively rapid growth, many commercial cattle feedlots do not have the most efficient facilities for handling and feeding cattle and calves. In many instances, the arrangement of the facilities requires relatively long drives in receiving, shipping, and feeding, and the labor requirements for performing these operations are excessive. Therefore, this study was undertaken to: (1) Measure the relative efficiencies of the various work methods and types and combination of types of equipment used in performing commercial feedlot operations, and (2) develop principles for use in planning improved facilities, including proper layout, design, and size.

In conducting this research, 14 feedlots of various sizes in different sections of the country were selected for case study. Data were obtained through time studies of performance of each feedlot operation at each feedlot selected. Specific operations and facilities on eight other feedlots also were studied. Cost and labor requirements termed "typical" in this report are based on observations of these feedlots.

## THE COMMERCIAL CATTLE FEEDLOT BUSINESS

The commercial cattle feedlot business is one of putting gains on animals for owners on a custom basis while cattle are yarded in pens. Two types of charges are commonly used for doing the job. One type is a yardage charge of so much per head per day plus a specified markup on feed fed. The other type is a specified flat fee per pound of gain. Most feedlots prefer the first type. With this type they are relieved of the responsibility of putting gains on animals at a fixed fee. However, the agreements vary from feedlot to feedlot and also from one time to another in the same feedlot. In some feedlots the terms of the feeding agreement may stipulate that the management will assume a part of the responsibility for losses from injuries and deaths.

Small feedlots may feed the cattle of as many

as 15 owners at one time while large feedlots may feed as many as 45. In addition, in feedlots of all sizes, the owner may purchase and feed several pens of cattle. Most feedlot operators purchase cattle to feed only when their facilities are not fully utilized on a custom basis. Cattle are fed on most feedlots once a day; however, some markets feed twice a day, and in a few instances cattle owners specify three feedings daily. Because the cattle of different owners vary as to time of arrival, condition, and size, the feedlots are required to feed several different types of rations daily. Also, at different stages of gains the rations are changed. Therefore, most feedlots are required to feed a minimum of three different rations daily and some as many as six. Furthermore, adjacent pens of cattle may be fed different rations. Consequently, feeding becomes a complicated problem.

The length of time cattle remain in the feedlot is variable, depending primarily on the gain desired, and the rate of gain. The weights of the cattle received on the feedlots range from 400 to 800 pounds. Most of the observed feedlots finished out cattle at weights ranging from 750 to 1,200 pounds. Most feedlots consider an average gain of 2.5 pounds per day satisfactory. For purposes of this report a feeding period of 120 days is assumed. On this basis a feedlot would handle three times its capacity per year.

Receiving cattle includes unloading the cattle from the trucks onto the feedlot, assigning them a pen, and driving them to and yarding them into the pen. A commercial cattle feedlot operates 7 days a week. On most feedlots, the workday is limited to daylight hours, generally beginning about 7 a.m. and ending about 5 p.m., and cattle are received during these hours. However, cattle are not received every day in the week, but periodically. In receiving cattle they may be branded, wormed, castrated, dehorned, and vaccinated. These operations are performed at the owner's request. Consequently they are not performed for all cattle received on the feedlot. A per-head charge may be made by the feedlot for each service performed.

Maintaining the health of animals is highly important on all feedlots. Thus, a daily inspection is made of each animal. Animals showing signs of illness, or injured animals are immediately taken from the feed pens to hospital pens where they are given prompt attention. Costs for medication are defrayed by the owner of the animals. As a result of the daily inspection and care given animals, death losses on feedlots are considered low. Most feedlot operators say death losses, including animals removed and slaughtered for various reasons, average about 2 percent.

In commercial feedlot operations the responsibility for the business functions rests usually with the manager, who in most cases is the owner. He solicits business, employs the feedlot personnel, supervises operations, purchases feed and equipment, and in most cases he plans, designs, and engineers his feedlot.

## DESCRIPTION AND DEFECTS OF FEEDLOT FACILITIES

The facilities used on cattle feedlots are basically similar. The facilities may be grouped as follows: Facilities for receiving and loading out cattle, pen facilities, alleys, feeding facilities, equipment barn, fencing, watering facilities, parking areas, management office, and other facilities such as windbreaks and shade. The kind, amount, and the arrangement of facilities used by commercial feedlots vary widely. For illustration, some feedlots use self-mixing self-unloading feed trucks for mixing feed, while others use a feed mill. The number of feeding pens may be greater on one feedlot than another. Furthermore, the arrangement of the various components in relation to one another is different for practically every feedlot.

The sites for commercial feedlots vary widely in size and shape. Commercial feedlot sites range from a few acres to several hundred. At the time this research was conducted the floors of the pens in all feedlots in which observations were made were of dirt. Consequently this analysis is based on feedlots with dirt floors. However, several commercial feedlots now in operation have pens with concrete floors. A major difference between feedlots with pens with dirt floors and with concrete floors is that the feedlots with concrete floors are of a smaller size for a given volume.

### Receiving and Loading Out Cattle

Generally cattle move into and out of commercial feedlots by truck. The facilities for receiving and loading out cattle consist of a truck dock; scale house, scale, and scale platform; and working alley and catch pens.

#### Truck Dock

Most of the feedlots observed had only one truck dock. The truck dock generally consists of a platform, chute, and chute pen. The dock platform is the fixed-height type constructed for a semitrailer truck. The floor of the chute is the ramp-type in most feedlots and is constructed of either wood or rough concrete. Chute fences are of wood construction and are 48 to 54 inches high. The chute on most feedlots is about 4 feet wide. The chute pens vary in size; however, most are adequate to hold a truckload of cattle.

The truck dock is used very infrequently;

therefore elaborate facilities are not necessary. Each truckload of cattle uses the dock less than 10 minutes coming in and about the same amount of time when they leave the feedlot. Many docks are located inconveniently and some distance from the feeding pens; consequently, unusually long drives of cattle are mandatory in yarding them into pens.

### Scale House, Scale, and Scale Platform

A scale and a scale platform are located on the feedlot for weighing cattle as they are received onto or as they are shipped from the feedlot. Most scales are of the weigh-beam type, and have a weighing capacity of 10,000 pounds. The scale platforms range from 8 by 14 feet to 10 by 34 feet. Scale houses are about 3 feet wide and 5 feet long. In many instances the weighing capacity of the scale is inadequate and the scale platform too small for weighing efficiently the size of lots handled. Often it is necessary that the size of the lots to be weighed be divided into two or three drafts.

Frequently the scale platform is so located with respect to the chute pen of the dock that the animals must make a right-angle turn before being driven onto the scale platform. Consequently, delays are encountered in weighing cattle. The same situation frequently exists when driving cattle from the scale platform. In a few instances the scale platform is located a relatively long distance from the truck dock. This causes delays in the receiving of cattle.

### Working Alley and Catch Pens

All feedlots studied provided catch pens for holding cattle temporarily, before they are sorted, dehorned, vaccinated, branded, wormed, or castrated. These operations are performed in an adjacent working alley. Within the working alley is a squeeze chute into which cattle are driven singly and immobilized while the different operations are being performed on them. The number of catch pens on feedlots varies widely, ranging from 2 to 15. Frequently the number of catch pens is inadequate for the volume handled. The sizes of the catch pens also vary. However, most are too large for the size of lots handled.

Frequently the catch pens are arranged so that the gates to the pens do not open directly onto the working alley; consequently, out-of-line drives and excessive labor requirements are encountered in moving cattle from the catch pens to the working alley.

Occasionally the working alleys are so located that direct drives from the alley to the feeding pens cannot be made; thus indirect drives are mandatory.

## Pens

Pen facilities are of three types—pens for feeding cattle, hospital pens, and runaround pens.

### Pens for Feeding

Pens for feeding cattle vary widely in size, ranging from 60 feet square to about 1,500 feet square. The size on many feedlots is 100 feet square. In many instances pens were too large or too small for the size of the lots of cattle fed in them. Generally, most feedlots have too many large pens for them to feed the numerous small lots of cattle consigned to them and to efficiently utilize their pen space. Pens on most feedlots on which observations were made were square; the primary reason for this was the economy of fencing.

A variety of materials is used in constructing cattle-pen fences. Among these are wood, aluminum pipe, wire, and cable. Fences usually are 54 to 60 inches high. Those feedlots using pipe, wire, or cable usually use either four or five rails or strands on all sides other than the feed-bunk side. The feed-bunk side generally uses two strands. Feedlots using wood use four 2- by 8-inch boards. Fence posts average about 12 feet apart, and are of either wood or pipe.

All pens for feeding cattle are equipped with a feed bunk. Feed bunks are constructed of wood, concrete, or cinder block. The bunks are constructed so that cattle have access to them from inside the pen and the feed trucks have access to them from outside the pen. Actually, the feed bunk is a part of the fence of the pen.

The feed bunks are from 8 to 12 inches high on the cattle's side and from 15 to 20 inches high on the side accessible to feed trucks. In many instances the bottoms of the bunks are square rather than rounded and as a result, cattle are unable to consume all the feed because it tends to cling to the corners. The bottom of the bunk is about 18 inches wide. The height of the bunks on the side accessible to trucks prevents feed loss when feed is delivered into them by the feed outlet spout attached to the feed trucks. The height of the bunk on the cattle side permits cattle to feed easily and comfortably. Adjacent to the bunk on the cattle side, many feedlots construct a concrete platform about 6 inches thick and 5 to 7 feet deep for cattle to stand on while eating.

Feed bunk space is often inadequate to feed the number of cattle the pen was designed to hold. This situation again results in low pen space utilization. Frequently more bunk space is constructed in one pen than the pen was designed to hold, resulting in a low utilization of bunk space. Sometimes excessive bunk space tends to cause more animals to be placed in the pen than it can hold without crowding.

Wooden feed bunks tend to decay or wear, (fig. 1). This results in a high maintenance cost and also an excessive loss of feed.

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FIGURE 1.—Wooden feed bunks wear quickly.

### Hospital Pens

Hospital pens are for holding sick or injured animals. All of the feedlots studied provided hospital pen facilities. Usually hospital pens are designed to hold one animal because the feedlot operators do not believe it good practice to place animals with different diseases, or two injured animals, in the same pen. Occasionally, however, animals with the same diseases are placed in the same pen if a pen of adequate size is available. The number of hospital pens in the feedlots studied ranged from 2 to 25. Generally the hospital pens on most feedlots are too large. In some instances the number of hospital pens appeared excessive in relation to the volume handled. All hospital pens are equipped with feed bunk and water facilities, and most were covered and enclosed.

### Runaround Pens

A runaround pen is a pen in which recuperating, sick, or injured animals are placed so that they may have ample exercise room. Most feedlots had one runaround pen but a few had two or more. Runaround pens are comparatively large; a common size is 100 feet square. A runaround pen reduces the necessity for a large number of hospital pens. They are equipped with a feed bunk and watering facilities. Such pens should be located adjacent to the hospital pens to minimize the amount of labor required for handling animals, but on some observed feedlots they were located a considerable distance from the hospital pens.

## Alleys

Alleys of proper size and location are essential for a free flow of cattle to and from such components as the shipping dock and chute pen, scale and scale platform, catch pens and working pens, feeding pens, hospital pens, and runaround pens. Their size and location should also allow for a free flow of feed trucks between the pens and the facilities for storing or mixing feed or both.

Two types of alleys are common to most feedlots—a driving alley and a feeding alley. The first permits cattle to flow between the various components of the feedlot, and ranges from 10 to 12 feet in width. The second type permits feed trucks to make feed deliveries to bunks in the feeding pens, and varies from 16 to 40 feet in width. The usual width is about 20 feet.

Separate alleys for driving cattle and making feed deliveries prevent interference in the performance of the two operations. However, many of the small feedlots with both types of alleys do not have sufficient interference between the two operations to justify the two types. On the other hand, some of the larger yards do not have the two types of alleys and, as a result, congestion, delays, and excessive labor are incurred in both operations.

## Feeding Facilities

Feeding facilities are divided into two types—barn facilities and mill facilities. For the purposes of this study barn facilities include facilities used in storing feed and mixing and loading feed into the self-mixing self-unloading truck; mill facilities include facilities used in storing, mixing, and loading feed into the self-unloading truck.

### Barn Facilities

Feed barns vary in size, and are usually constructed of wood. A typical one is rectangular —about 30 feet wide and 60 feet long, and is divided into two compartments of about the same size. One compartment is used for storing grain and the other, concentrates. The compartment used for storing grain is equipped with a hopper bottom so that grain may be received at the top and augered out at the bottom. Most grain compartments are equipped with a 6-inch grain auger with a 3-horsepower motor. The compartment used for storing concentrates is equipped with a concentrate bin, a storage area for stacked bags of concentrates, a portable platform scale, and a sheet-metal hopper with about a 30-inch diameter to which a 4-inch auger is attached.

Concentrate bins usually are about 4 feet square and about 30 inches deep. They are used for storing quantities of concentrates temporarily, before being loaded into the feed truck bed.

Concentrates arrive at the barn in 100-pound bags on small feedlots that do not use a feed mill, and are stored along the wall of the compartment. The portable platform scale is used for weighing small quantities of concentrates, which is quicker than by weighing them on the scale platform, which is usually near the barn. A sheet-metal hopper is used for holding concentrates before augering it onto trucks.

In most cases, barns are designed for housing a 30-day supply of feed. Most compartments used for concentrates are too large for the supply stored. The compartments are equipped with augers for augering grain and concentrates from the compartments onto the self-mixing truck. Scale platforms are about 10 feet wide and 24 feet long, so that the self-mixing feed trucks can drive onto them and weigh grain and concentrates immediately after each has been augered into the trucks. The scales usually have a weighing capacity of 10,000 pounds.

A silage wagon about 7 feet wide, 12 feet long, and 3 feet deep is usually used for hauling silage from the trench silo to the platform scale, located in an open area on the feedlot. The wagons have a capacity of from 5,000 to 7,000 pounds. Silage is stored in the wagon before being loaded onto the feed truck. Usually, an 18-inch belt conveyor is used to convey it from the wagon onto the self-mixing truck. The silage wagon and platform scale are called the silage loading station on most feedlots, (fig. 2), and are located 60 to 200 feet from the feed barn. Workers loading feed onto trucks must make two stops in performing the job. The arrangement also requires the use of two scales and scale platforms, one near the feed barn and the other at the silage loading station. Most feedlots use at least two trench silos. These are usually located quite a distance from either the feed barn or the silage loading station. The trench silos vary in size, ranging from 16 to 40 feet in width, 100 to 200 feet in length, and 8 to 15 feet in depth. They have a capacity ranging from 400 to 1,000 tons of silage. In many instances the silos are too shallow and the spoilage rate is excessive; further, the silo occupies a relatively large area in relation to its capacity.

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FIGURE 2.—Loading silage from silage wagon onto a truck at a silage loading station. This equipment is used with the self-mixing, self-unloading truck method. The truck is positioned on a scale platform.

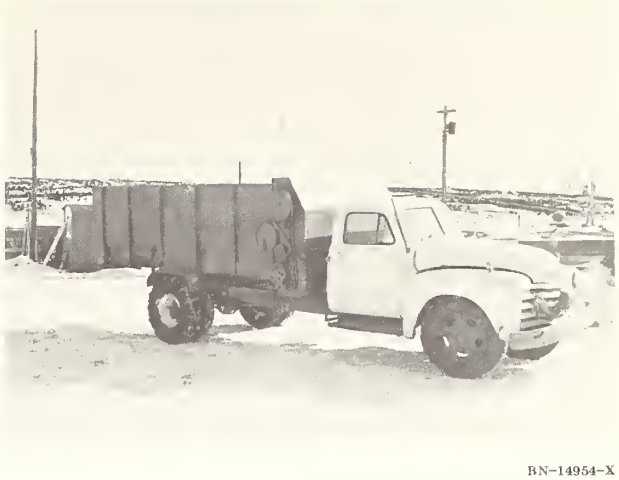

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FIGURE 3.—A self-mixing self-unloading feed truck used on feedlots that do not have a mixing mill.

The self-mixing feed truck has a feed box containing a rotating cylinder with paddles for stirring feed (fig. 3). The cylinder operates from a power takeoff connected to the transmission of the truck. Such trucks have capacities ranging from 6,000 to 12,000 pounds.

Facilities used for storing feed, when mixing with a self-mixing truck—that is, those facilities that do not have a feed mill—have their limitations as to the types of rations that can be made. For illustration, hay cannot be used in a ration with these facilities. Molasses is not commonly used with them. Furthermore, these types of facilities do not provide for cracking the grain used in the rations.

## Mill Facilities

When the feeding facilities include a mixing mill, the feed is stored in various components of the mill and in trench silos. The components of the mill are upright silos, grain rolls, hay chopper, silage pit, molasses pit, overhead storage bins, mix box, control panel, and scale and scale platform. These facilities are commonly used by feedlots feeding a comparatively large number of cattle.

The number of upright silos varies from four to nine, depending on the capacity of the mill, and they are used for storing grains (corn, milo, maize, barley) and concentrates. The grain rolls are used for cracking grain, and the hay chop-

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per for chopping hay. The silage is held in the silage pit pending its use in mixing. The molasses pit is used to store molasses before it is used in the feed mixture. The overhead bins store mixed feed before it is loaded onto feed trucks. The scale and scale platforms are located underneath the overhead bins and are for weighing the desired amount of feed onto trucks. The mill automatically mixes the feed and is operated from a central control panel. The mixing capacity of mills varies widely—ranging from 40,000 to 75,000 pounds per hour. However, most feedlots operate their mills at less than capacity.

The trench silos are essentially the same as those used in feedlots without mills. The only difference is that they have a larger capacity, which ranges from 1,000 to 5,000 tons.

## Equipment Barn

Equipment barns are used for housing and the repair of trucks, tractors, and silage loaders, and for storing spare parts and miscellaneous supplies. Their sizes vary widely, depending on the amount of equipment involved. The barns are usually about 30 feet deep and from about 30 to more than 100 feet long. One entire side of the barn is open and frequently equipped with sliding or horizontal doors; the other three sides are closed. Equipment barns are usually located near the management's office. On small feedlots barns are usually too large and on large feedlots they usually are too small.

## Fencing

The facilities of some feedlots are enclosed with a fence to provide protection to animals that might escape from the pens, and to keep unauthorized persons from the premises. Many feedlots are not fenced.

## Watering Facilities

Each cattle feeding pen has a water tank to supply fresh water. There are two general types of watering facilities—the concrete tank and the automatic waterer.

The concrete tanks are about 7 feet in diameter and 18 inches deep. The bottom of the tank is near ground level. The concrete sides and bottom are about 6 inches thick. An inlet device is in the bottom of the tank and a float controls the level of water. The tanks may be heated in freezing weather with a portable butane or oil heater.

The automatic waterer is a much smaller container, (fig. 4). It is about 3 feet in diameter and 18 inches high. It has an inlet at the bottom and a float control maintains its water supply at about 18 gallons. This type of watering facility

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FIGURE 4.—Automatic waterers (right) have replaced the conventional concrete water tanks on many feedlots. Note the concrete tank and feed barn in the rear.

is heated in cold weather by a 250-watt infrared reflector-type lamp. The lamp is screwed into a socket in the center of the bottom and is thermostatically controlled. It starts when the temperature goes down to 33° F. and automatically cuts off when the temperature rises above 33° F.

## Management Office

The management office is usually of frame or sheet metal construction (fig. 5). The offices vary widely in size. Some offices provide space for only a desk, telephone, and a file cabinet. Others are comparatively elaborate, and include a general office, one or two private offices for top management, and toilet facilities. Frequently they are equipped with a public address system for maintaining contact with feedlot workers. The office is a control point for many of the operations. The office is often located too far away

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FIGURE 5.—A typical office on a small feedlot.

from the focal point of feedlot operations, causing considerable time lost by supervisors and workers when personal contacts are necessary.

## Parking Areas

Very few feedlots have definite parking areas and as a result vehicles of employees and patrons are parked haphazardly. Such random parking often interferes with the efficient performance of feedlot operations.

## Other Facilities

Other facilities consist of windbreaks, pen shades, and back scratchers. Whether or not a feedlot uses these facilities depends mainly on the climatic conditions of the area in which the feedlot is located.

### Windbreaks

Windbreaks are used for the purpose of providing protection to the cattle, and are used primarily in feedlots in those sections of the country where snow and cold winds are a problem. They are generally constructed of 1-inch boards about 7 feet high and are located on the side of the pen that affords the most protection from prevailing winds and snowdrifts.

### Pen Shades

Pen shades are for protecting cattle from high summer temperatures, (fig. 6). They are generally constructed of wirebound, wooden picket-type fencing. The pickets are approximately ¼ inch thick, 2 inches wide, and 3 feet long. The shades are about 10 to 12 feet above the pen floor and are located over the middle of the pen. Several rows of the pickets are often used to provide the desired width of the pen shade.

### Back Scratchers

Some feedlots provide back scratchers in their feeding pens so that the cattle may rub against them (fig. 7). A back scratcher is a horizontally suspended arm with a burlap type cloth attached at cattle back level. The device is so arranged that the cloth is always saturated with an insect repellant. The repellant is placed on the animal's back through contact with the scratcher, and prevents flies and other insects from molesting the cattle.

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FIGURE 6.—Pen shades are common to many feedlots. The above shades are made of pickets. Note the wood fence construction in foreground.

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FIGURE 7.—Back scratchers are used in many feedlots to assist in controlling flies and insects during hot weather.

# FEEDLOT OPERATIONS

In this report commercial feedlot jobs are divided into eight major operations. These are: (1) Receiving cattle; (2) preparing feed orders; (3) feeding; (4) inspecting; (5) care of sick and injured cattle; (6) mounding manure; (7) loading out cattle; and (8) cleaning pens. Receiving and loading out cattle, mounding manure, care of sick and injured, and cleaning pens are performed periodically. Preparing feed orders, feeding, and inspecting are done every day in the week.

Method studies made on selected feedlots show a high degree of similarity in the methods used to perform all operations except feeding. Three distinct methods are used in feeding. Therefore all operations except feeding are analyzed on the basis of layouts and sizes of feedlots. Two types of layouts and three different sizes of feedlots are selected. The layouts are the typical, representative layout and the improved layout, such as those described in this report. The distances of travel shown for both are average distances.

The feeding operation is analyzed on the basis of methods, layout, and size of feedlot. The three sizes of feedlots selected are those with a capacity (1) for 1,000 head; (2) for 5,000 head; and (3) for 10,000 head.

Individual animals are unpredictable and may react differently in comparable situations. Therefore, the time study data on the various operations should be used only as a general guide to labor requirements. The productive labor requirements for specific time items by feeding methods are shown in table 15 in the appendix.

Labor and equipment requirements and costs presented in this section are on a "per-head" basis because most feedlot operators compute their costs on this basis. Furthermore, the requirements and cost figures are based on the total annual volume the feedlot would handle. Thus, a feedlot with a capacity for 1,000 head would handle 3,000 head annually, assuming a 120-day feeding period. Management and facility costs have not been included; therefore the data do not reflect total feedlot costs.

The assumed wage rate on which costs were based is $1.25 per hour for all labor except mill operators. The assumed wage rate for mill operators was $2 per hour. Supervisory personnel were not included.

Data on equipment costs were obtained from manufacturers and are based on average f.o.b. factory prices for 1959 and 1960. These costs were grouped into two major categories—ownership costs and operating costs (see table 14 in the appendix).

Ownership costs were considered to be fixed and include depreciation, taxes, interest, and insurance. Interest rates were based on 6 percent of the average investment and a combined figure for taxes and insurance was based on 4 percent of the initial investment. Operating costs were based on representative costs of fuel, electricity, and maintenance of equipment used in commercial cattle feedlots.

In some instances, certain items which might normally be classified as facilities were classified as equipment herein for comparative purposes. For illustration, the feed barn used with one method of feeding was classified as equipment because the upright silos used in other methods are an integral part of the mill equipment.

## Receiving Cattle

Receiving cattle onto commercial feedlots includes driving the cattle from the trucks into a chute pen, from the chute pen onto the scale platform, making weight determinations and recording them, driving cattle from the scale platform into catch pens, from the catch pens into the working alley, working the cattle (dehorn, castrate, worm, brand, vaccinate), and driving cattle from the working alley to the feeding pens, (fig. 8).

All the cattle received into feedlots do not receive all the services listed under the classification of working animals. However, it is estimated that all cattle receive 40 percent of the services. Thus the labor requirement and cost data for receiving cattle were based on the assumption that all the cattle would receive two of the five services rendered.

Cattle are generally received onto feedlots in truckload lots; the truckload lot assumed for this study is 25 head—the average size on feedlots on which observations were made. Crews for receiving cattle ranged from two to four workers. When the receiving is performed with four workers the elapsed time for it is reduced; however, the labor requirements are about the same as when two workers were used. As previously stated, cattle are received on feedlots periodically and the workers who perform the receiving operations also perform other duties.

The labor requirements for unloading, making weight determinations and recordings, driving cattle to the catch pen, and working cattle were relatively constant. However, the labor requirements for driving cattle from the working alley to the feeding pens vary widely because of: (1) The size of the lots driven, and (2) the distance of the drives. In relatively small feedlots usually only one lot of cattle is worked and driven to the feeding pens at one time. In the larger feedlots frequently two or more lots are driven from the working alley to the feeding pens at one time. The man-hours required to drive a small lot of cattle a specified distance is nearly as great as that required to drive a large lot. Thus the labor requirements per head for driving cattle are influenced by the number of animals in the lot driven.

The average distances of the drives for feedlots with a capacity for 1,000 head with a typical

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FIGURE 8.—The squeeze chute is used to immobilize cattle while they are being branded, dehorned, vaccinated, castrated, or wormed.

layout and an improved layout were 500 and 400 feet respectively; for a feedlot with a capacity for 5,000 head 1,000 and 750 feet; and for feedlots with a capacity for 10,000 head 1,600 and 1,000 feet.

The equipment costs for feedlots with both the typical and improved layouts are based on the use of a scale and scale platform. The labor costs per head for receiving cattle in a typical feedlot increases as the capacity of the feedlot increases but not in the same proportion (table 1.). The primary reason for this is that the larger the feedlot the longer the drive from the work alley to the feeding pens, and the larger the feedlot the larger the group of animals being driven. The same situation holds for feedlots with an improved layout.

An improved layout for a feedlot with a capacity for 1,000 head reduces the driving distances for receiving cattle 27 percent and the cost 14 percent, the actual reduction in cost amounting to 3 cents per head or $90 annually, based on handling 3,000 head; an improved layout for a feedlot with a capacity for 5,000 head reduces the driving distance 25 percent and the cost 11 percent, the reduction in cost amounting to 2 cents per head or $300 annually, based on handling 15,000 head; and an improved layout for a feedlot with a capacity for 10,000 head reduces the driving distance 37 percent and the receiving cost 24 percent, the reduction in cost amounting to 5 cents per head or $1,500 annually, based on handling 30,000 head.

TABLE 1.—*Labor and equipment requirements and costs per head for receiving cattle in feedlots with typical layouts and feedlots with an improved layout, by size of feedlots*

| Feedlot capacity | Average driving distance | Requirements | | Costs | | |
|---|---|---|---|---|---|---|
| | | Labor | Equipment | Labor | Equipment | Total |
| *Head* | *Feet* | *Man-hours* | *Machine-hours* | *Dollars* | *Dollars* | *Dollars* |
| Typical layout: | | | | | | |
| 1,000 | 550 | 0. 11 | 0. 01 | 0. 14 | 0. 07 | 0. 21 |
| 5,000 | 1, 000 | . 13 | . 01 | . 16 | . 02 | . 18 |
| 10,000 | 1, 600 | . 16 | . 01 | . 20 | . 01 | . 21 |
| Improved layout: | | | | | | |
| 1,000 | 400 | . 09 | . 01 | . 11 | . 07 | . 18 |
| 5,000 | 750 | . 11 | . 01 | . 14 | . 02 | . 16 |
| 10,000 | 1, 000 | . 12 | . 01 | . 15 | . 01 | . 16 |

## Preparing Feed Orders

To prepare feed orders, a worker tours the pens, noting the amount of feed remaining in the feed bunk, and determines the type and amount of feed to be delivered to each pen. The worker then returns to the office and prepares feed orders for each pen of cattle and delivers them to the feed loading point. The time required to perform this job varies with the size of the feedlot—ranging from about an hour in the comparatively small feedlots to more than 4 hours in the relatively large feedlots. The operation is performed in the same manner on all feedlots.

The average walking distances for preparing feed orders in feedlots with a capacity for 1,000 head and with a typical and an improved layout are 1,900 and 1,400 feet, respectively; for feedlots with a capacity for 5,000 head, 6,000 and 4,700 feet; and for feedlots with a capacity for 10,000 head, 10,000 and 7,800 feet. No equipment is used in performing the operation. The cost on a per-head basis for preparing feed orders decreases as the size of the feedlot increases, with both a typical and an improved layout, but not in the same proportion.

An improved layout for a feedlot with a capacity for 1,000 head reduces the walking distances for preparing feed orders 26 percent and the cost 21 percent (table 2). The total reduction in cost is 3 cents per head, and based on a yearly volume of 3,000 head, the annual reduction would amount to $90. An improved layout for a feedlot with a capacity for 5,000 head reduces the walking distance 22 percent and the

TABLE 2.—*Labor requirements and costs per head for preparing feeding orders, by size of feedlot, for feedlots with a typical layout and feedlots with an improved layout*

| Feedlot capacity | Requirements | |
|---|---|---|
| | Labor | Costs |
| *Head* | *Man-hours* | *Dollars* |
| Typical layout: | | |
| 1,000 | 0. 11 | 0. 14 |
| 5,000 | . 08 | . 10 |
| 10,000 | . 07 | . 09 |
| Improved layout: | | |
| 1,000 | . 09 | . 11 |
| 5,000 | . 06 | . 08 |
| 10,000 | . 05 | . 06 |

cost 20 percent. The actual reduction in cost is 2 cents per head. On the basis of handling 15,000 head annually the cost reduction would amount to $300. For feedlots with a capacity for 10,000 head the walking distance is reduced 22 percent and the cost 33 percent. The total reduction in cost amounts to 3 cents per head. On the basis of the feedlot handling 30.000 head annually, this would amount to $900.

## Feeding

The type of feeding included in this report involves mixing feed and delivering it to the feed bunks. The feed consists of grain, protein pellets, and silage. As previously stated, some feedlots feed 2 or 3 times a day. However, this analysis is based on feeding once a day, the common practice on most feedlots. Three methods are employed in feeding cattle. These methods, identified by the kind and capacity of the mixing equipment used, are: Self-mixing self-unloading truck; mixing-mill self-unloading feed truck (mill capacity 40,000 pounds of feed per hour); and mixing-mill self-unloading feed truck (mill capacity 75,000 pounds of feed per hour).

In feeding cattle, one truckload of feed is augered into one pen. The sizes of the loads of feed vary with the size of feedlots. The average load for feedlots with a capacity for 1,000 head is 1,500 pounds; with a capacity for 5,000 head, 2,940 pounds; and for feedlots with a capacity for 10,000 head, 5,160 pounds.

Labor and equipment requirements and cost figures shown are for feedlots with a capacity for 1,000 head; for feeding with the aid of a feed mill computed figures are used. No feedlots of this size were noted during the research to be using a feed mill. On the other hand, no feedlots with a 5,000- or 10,000-head capacity were noted to be using a feed barn and a self-mixing self-unloading truck to feed cattle. The computed figures are for comparative purposes only and are presented here as a guide to operators in determining their lowest costs in relation to volume handled.

### Self-Mixing Self-Unloading Truck Method

Use of a self-mixing self-unloading truck in feeding cattle involves augering and weighing grain and pellets into the truck bed, driving the truck from the feed barn onto the scale platform at the silage station, loading and weighing silage into the truck bed, driving the loaded truck to feed bunks, augering feed into bunks, driving the empty truck from the pen area onto the scale platform at the feed barn, and transporting silage from a trench silo on the feedlot to the nearby silage loading station. The last operation is performed periodically, depending on the size of the feedlot; the others are performed several times a day every day in the week.

The equipment requirements for feeding cattle with this method are based on the use of a feed barn (including a 6-inch grain auger, a 4-inch pellet auger, and a 20,000-pound capacity platform scale); a silage loading station (including a silage conveyor, silage wagon, and a 20,000-pound capacity scale platform); a silage loader, a tractor, and 6,000-pound self-mixing self-unloading truck. Feedlots with a capacity for 1,000 head have two self-mixing self-unloading feed trucks; 5,000 head—4 trucks; and 10,000 head—8 trucks.

In small feedlots one worker with a self-mixing self-unloading truck does the feeding jobs. A second truck is maintained in case of a breakdown of the first truck. In feedlots with a capacity for 5,000 head, 4 workers, each with a truck are required, and in feedlots with a 10,000-head capacity 8 workers, each with a truck, are required to do the feeding jobs.

In feeding cattle with this method the worker weighs his empty truck, starts the auger in the grain compartment of the feed barn to auger grain into the bed of the truck, then goes into the pellet compartment and manually loads pelleted feed into a hopper. He then returns to the scale, checks the weight of the grain in the truck, and when the proper quantity is in it, he stops the auger (figs. 9 and 10). He climbs onto the truck bed and manually levels the grain. Then he performs the same work in loading pellets. The worker drives the truck from the scale platform at the feed barn onto the scale platform at

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FIGURE 9.—A self-unloading truck, positioned for loading on a scale platform at the feed barn.

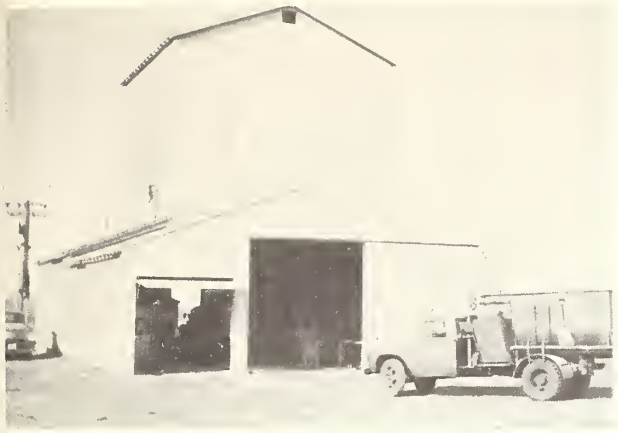

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FIGURE 10.—A feed barn.

the silage loading station where he loads and weighs silage onto the truck. He then drives the loaded truck to the feed bunks, positions the outlet spout over the feed bunk, and engages the mixing and augering mechanisms to mix and auger feed into the bunks. Feed is augered into the bunks as the worker drives the truck slowly alongside it (fig. 11). When the truck bed is empty he returns to the feed barn and drives the truck onto the scale platform and begins loading the truck again.

The equipment is the same for feedlots with a typical and an improved layout, except for a scale and scale platform. With the improved layout the silage loading station is located adjacent to the scale platform at the feed barn. Thus the improved layout makes it possible for the worker to load and weigh all ingredients on one scale located at the barn. The improved layout eliminates one scale and scale platform.

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FIGURE 11.—Augering feed from a self-unloading feed truck into a feed bunk.

The average driving distances in feeding cattle for feedlots with a capacity for 1,000 head, with a typical and an improved layout, are 800 and 650 feet, respectively; for a feedlot with a capacity for 5,000 head, 1,800 and 1,200 feet; and for feedlots with a capacity for 10,000 head, 3,000 and 1,700 feet. An improved layout reduces the driving distances in a feedlot with the capacity for 1,000 head, 19 percent; with a capacity for 5,000 head, 33 percent; and with a capacity for 10,000 head, 43 percent.

The labor costs per head for feedlots of all three sizes are relatively constant with typical layouts or with the improved layout (table 3). This is because the labor on a per-head basis for such time-consuming jobs as loading feed onto the truck bed and augering feed into feed bunks remains constant regardless of the size of the feedlot. The labor varies only for the transporting jobs. The equipment costs decrease as the size of the feedlot increases primarily because the equipment is utilized more fully in feedlots feeding a comparatively large number of cattle. The reduction in costs for feedlots of all three sizes with an improved layout is due in part to a reduction in the distances for hauling feed to bunks and in part to less equipment. A scale and scale platform at the silage loading station used in feedlots with a typical layout is not needed in feedlots with an improved layout.

TABLE 3.—*Labor and equipment requirements and costs per head for feeding cattle with the self-mixing self-unloading truck method, by size of feedlot, for a feedlot with a typical layout and an improved layout*

| Feedlot capacity | Requirements | | Costs | | |
|---|---|---|---|---|---|
| | Labor | Equipment | Labor | Equipment | Total |
| *Head* | *Man-hours* | *Machine-hours* | *Dollars* | *Dollars* | *Dollars* |
| Typical layout: | | | | | |
| 1,000 | 0.70 | 1.98 | 0.88 | 2.14 | 3.02 |
| 5,000 | .68 | 1.96 | .85 | .99 | 1.84 |
| 10,000 | .67 | 1.95 | .84 | .89 | 1.73 |
| Improved layout. | | | | | |
| 1,000 | .64 | 1.91 | .80 | 1.93 | 2.73 |
| 5,000 | .64 | 1.91 | .80 | .90 | 1.70 |
| 10,000 | .64 | 1.91 | .80 | .80 | 1.60 |

For a feedlot with a capacity for 1,000 head and an improved layout, costs are reduced 29 cents a head. On an annual basis this would amount to $870. For feedlots with a capacity for 5,000 head the reduction is 14 cents a head, or $2,100 annually. For feedlots with a capacity for 10,000 head the reduction is 13 cents, or $3,900 annually.

## Mixing-Mill Self-Unloading Truck Method

Feeding cattle with use of a mixing mill and self-unloading truck involves mixing feed, loading feed into the truck bed of the self-unloading truck, driving the loaded truck to the feed bunks, augering feed into the bunks, driving the empty truck to the mill, and transporting silage to silage pit. The job of transporting silage from a nearby trench silo to a silage pit adjacent to the mill is performed periodically (figs. 12 and 13). The other jobs are performed every day in the week.

There are two feeding methods involving the use of a mixing mill and self-unloading trucks. They are: (1) Mixing mill with 40,000-pound-per-hour capacity, and (2) mixing mill with 75,000-pounds-per-hour capacity. The differences between the two methods are: Number and capacity of silos, feed batch size, and number of feeding trucks. These factors affect labor and equipment requirements and costs; therefore, two methods involving the use of a mixing mill and self-unloading trucks are analyzed.

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FIGURE 12.—Loading a silage truck with a silage loader in a trench silo.

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FIGURE 13.—A well-designed silage pit. The drag in the bottom of the pit conveys the silage into feed mixing box of the feed mill.

### Mill Capacity 40,000 Pounds Per Hour

The equipment requirements for this method are based on the use of a mixing mill with a capacity for mixing feed at the rate of 40,000 pounds per hour; a silage loader, a 10,000-pound-capacity silage truck, and 6,000-pound-capacity feed trucks. The mixing mill includes 4 upright silos—3 with a capacity for approximately 22,500 bushels each for grain and one with a capacity for approximately 7,000 bushels for pellets; grain roll, hay chopper, silage pit, molasses pit, 4 overhead storage bins each with a capacity for 7,500 pounds, a 500-pound-capacity mix box, control panel, and a scale and scale platform. Feedlots with 1,000- and 5,000-head capacities have 2 trucks, and a feedlot with a capacity for 10,000 head has 3 trucks. Feedlots with a 10,000-head capacity have two additional 30,000-bushel upright silos. The same equipment is used for feedlots with a typical layout and for feedlots with an improved layout.

Two workers mix feed for all sizes of feedlots. In mixing feed, one worker holds appropriate buttons depressed until the indicator on the dial scale shows that the desired quantity of a specific dry ingredient (corn, maize, milo, barley, pellets, hay, and silage) has been conveyed into the mix box (fig. 14). When he presses the button to convey the first ingredient into the mix box, the box begins to function. Consequently, when the last ingredient is in the box, mixing is complete. He presses the button which provides the necessary contact for starting the conveyor to convey the feed to overhead storage bins (4 bins of 7,500-pound capacity each). Molasses is automatically added to the feed as it is being conveyed to the overhead bins. Feed is mixed in mills of this capacity in 500-pound batches. The second worker maintains the mill in proper working condition. Therefore, his duties during the operation are not specified. If the occasion demands,

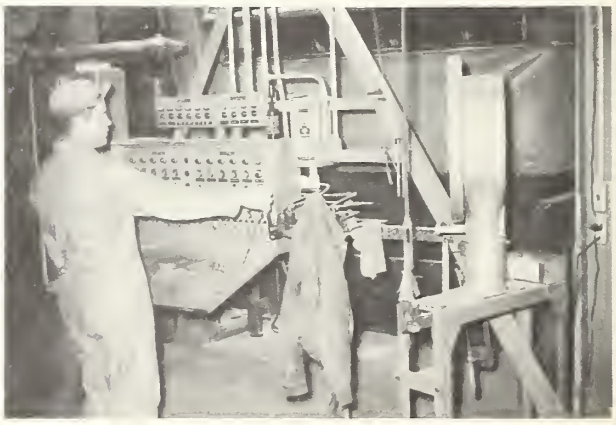

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FIGURE 14.—The control panel for a feed mixing mill. Feed is mixed and conveyed to overhead bins by the mill operator pushing specified buttons.

the worker may operate the mill. On some feedlots he transports silage in the silage truck from the trench silo to silage pit and operates the hay chopper.

In small feedlots one worker loads the feed onto a self-unloading truck, drives the truck to the feed bunks, and augers the feed into the bunks. The second truck on small feedlots is maintained in case of a breakdown of the first truck. In a feedlot with a capacity for 5,000 head 2 workers with trucks perform the feeding operation. Each truck driver loads his own truck. He positions his truck on the scale platform under the overhead bins (fig. 15). He then obtains the next feed order from the stack of feed orders, actuates the scale to weigh his empty truck, depresses the appropriate button until the indicator on the dial scale shows that the amount of mixed feed shown on the feed order has been dropped from the overhead bins into the bed of the feed truck. He then releases the button, returns to his truck, and drives the truck to the designated pen. He augers feed into the bunk in the same manner as described with self-mixing self-unloading truck method.

The labor costs per head for feedlots of all three sizes are relatively constant with either the typical layout or the improved layout (table 4).

The labor requirements and costs are less for feedlots of comparable sizes with improved layouts than for feedlots with typical layouts. The reduction is due primarily to reduced travel distances for hauling feed to feed bunks. The equipment cost, however, varies widely by size of feedlot for feedlots of different sizes with improved layouts and with typical layouts. This is because feedlots feeding a relatively large volume obtain fuller use of their equipment.

For improved-layout feedlots with a capacity for 1,000, 5,000, and 10,000 head, costs are reduced 7 cents per head. This would amount to $210, $1,050, and $2,100 respectively, on an annual basis.

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FIGURE 15.—A truck positioned for loading feed on a scale platform under the overhead storage bins of a mixing mill.

TABLE 4.—*Labor and equipment requirements and costs per head for feeding cattle using the mixing-mill self-unloading truck method (mill capacity 40,000 pounds of feed per hour), by size of feedlot, for feedlots with a typical layout and with an improved layout*

| Feedlot capacity | Requirements | | Costs | | |
|---|---|---|---|---|---|
| | Labor | Equipment | Labor | Equipment | Total |
| | *Man-hours* | *Machine-hours* | *Dollars* | *Dollars* | *Dollars* |
| *Head* | | | | | |
| Typical layout: | | | | | |
| 1,000 | 0. 37 | 0. 28 | 0. 54 | 4. 67 | 5. 21 |
| 5,000 | . 37 | . 28 | . 54 | 1. 19 | 1. 73 |
| 10,000 | . 37 | . 28 | . 54 | . 88 | 1. 42 |
| Improved layout: | | | | | |
| 1,000 | . 34 | . 25 | . 50 | 4. 64 | 5. 14 |
| 5,000 | . 34 | . 25 | . 50 | 1. 16 | 1. 66 |
| 10,000 | . 34 | . 25 | . 50 | . 85 | 1. 35 |

### Mill Capacity 75,000 Pounds Per Hour

The same jobs performed in feeding cattle with the mixing-mill self-unloading truck method (mill capacity 40,000 pounds per hour) are performed with this method, and in the same manner. The difference between the two methods is in the equipment.

The equipment requirements for this method are based on the use of a mixing mill with a capacity for mixing feed at the rate of 75,000 pounds per hour. The mixing mill includes 6 upright silos—5 for grain, each with a capacity for approximately 35,000 bushels and one with a capacity for approximately 14,000 bushels for pellets; grain rolls; hay chopper; molasses pit; a 10,000-pound-capacity silage pit; a 1,000-pound-capacity mix box; a 4-compartment overhead storage bin, each compartment with a capacity for 10,000 pounds; a scale and scale platform; and a control panel. The equipment requirements also include a silage loader; a 10,000-pound silage truck; and 12,000-pound self-unloading feed trucks (figs. 16 and 17). The same number of trucks are used with the various sizes of feedlots that are used with the mixing-mill self-unloading truck method (mill capacity 40,000 pounds of feed per hour). This mill mixes feed in 1,000-pound batches.

The labor requirements and costs on a per-head basis are relatively constant for feedlots of all sizes with a typical or improved layout (table 5). This is because the same amount of labor is required in mixing, loading, and unloading feed on a per-head basis regardless of the size of feedlot. Labor requirements vary for transporting feed to the feed bunks and returning the empty

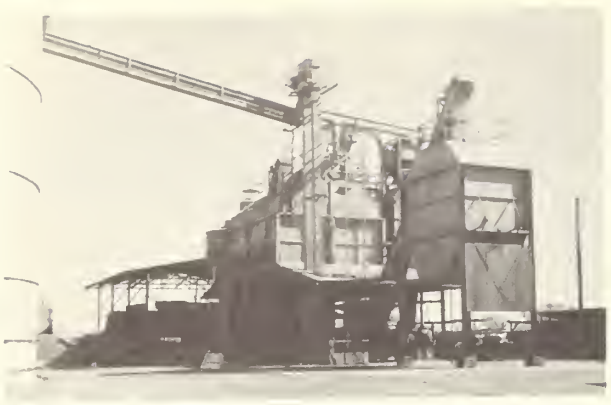

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FIGURE 16.—A mill for mixing feed. The mixed feed is stored in the overhead bins prior to loading into the self-unloading feed trucks.

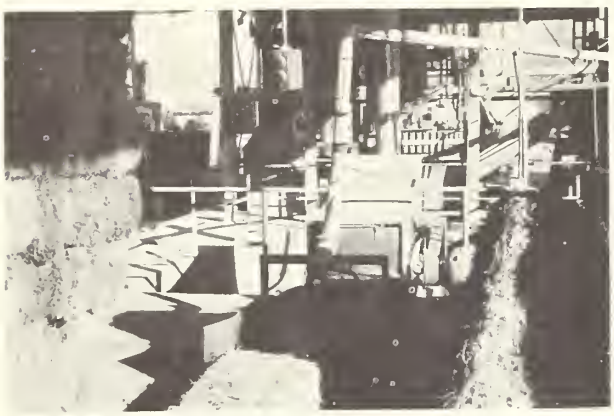

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FIGURE 17.—The hay chopper component of a feed mixing mill.

TABLE 5.—*Labor and equipment cost per head for feeding cattle using the mixing-mill self-unloading truck method (mill capacity 75,000 pounds per hour), by size of feedlot, for feedlots with a typical layout and with an improved layout*

| Feedlot capacity | Requirements | | Costs | | |
|---|---|---|---|---|---|
| | Labor | Equipment | Labor | Equipment | Total |
| | *Man-hours* | *Machine-hours* | *Dollars* | *Dollars* | *Dollars* |
| *Head* | | | | | |
| Typical layout: | | | | | |
| 1,000 | 0. 29 | 0. 25 | 0. 41 | 6. 35 | 6. 76 |
| 5,000 | . 29 | . 25 | . 41 | 1. 49 | 1. 90 |
| 10,000 | . 29 | . 25 | . 41 | . 92 | 1. 33 |
| Improved layout: | | | | | |
| 1,000 | . 26 | . 21 | . 37 | 6. 32 | 6. 69 |
| 5,000 | . 26 | . 21 | . 37 | 1. 46 | 1. 83 |
| 10,000 | . 26 | . 21 | . 37 | . 89 | 1. 26 |

truck to the mill by size of feedlots because of the different distances of travel involved. On a per-head basis the variations in labor costs are offset by the difference in number of cattle fed per trip in various sizes of feedlots.

The equipment costs per head for feeding cattle in the feedlots of different sizes with a typical or an improved layout vary widely. A fuller utilization of equipment in the large feedlot accounts for the decrease in equipment cost as the volume fed increases.

## Comparison of Methods

The labor and equipment costs per head for feeding livestock by methods, by size of feedlots, for feedlots with a typical layout and an improved layout are shown in table 6. The cost per head for feeding cattle with the mixing-mill self-unloading truck method (mill capacity 40,000 pounds per hour) in feedlots with a capacity for 1,000 head and with a typical layout is about 72 percent more than the cost for feeding cattle in a feedlot of similar size and layout with the self-mixing self-unloading truck method. The costs are more than double for feedlots of this size using the mixing-mill self-unloading truck method (mill capacity 75,000 pounds per hour). The same situation exists with respect to feedlots of a similar size with an improved layout. All the increased costs with the mixing-mill self-unloading truck method are in equipment cost. Labor costs are lower. All the increase in equipment cost is primarily in the cost of the mill. Thus feedlots with a 1,000-head capacity cannot obtain the lowest feeding cost with either of the mill methods.

The costs per head for feeding cattle in feedlots with a capacity for 5,000 head, and a typical layout are lower with the mixing-mill self-unloading truck method (mill capacity 40,000 pounds per hour) than with either the self-mixing self-unloading truck or the mixing mill self-unloading truck methods (mill capacity 75,000 pounds per hour). The reason for this is that with the mixing mill self-unloading truck method (mill capacity 40,000 pounds per hour) a more efficient utilization is obtained by labor and equipment. Equipment costs are lower with the self-mixing self-unloading truck method than for the other two methods, but labor is higher. With the mixing-mill self-unloading truck method equipment costs are higher but labor costs are lower. The same situation exists with respect to feedlots of a similar size with an improved layout.

The cost per head for feeding cattle in feedlots with a capacity for 10,000 head and a typical layout with the mixing-mill self-unloading truck method (mill capacity 75,000 pounds per hour) is lower than that for either of the other two

TABLE 6.—*Labor and equipment costs per head for feeding cattle by methods, by size of feedlot, for feedlots with a typical layout and an improved layout*

| Feedlot capacity | Self-mixing self-unloading truck method | | | Mixing mill self-unloading truck (mill capacity 40,000 pounds per hour) method | | | Mixing mill self-unloading truck (mill capacity 75,000 pounds per hour) method | | |
|---|---|---|---|---|---|---|---|---|---|
| | Labor costs | Equipment costs | Total | Labor costs | Equipment costs | Total | Labor costs | Equipment costs | Total |
| *Head* | | | | | | | | | |
| Typical layout: | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* |
| 1,000 | 0. 88 | 2. 14 | 3. 02 | 0. 54 | 4. 67 | 5. 21 | 0. 41 | 6. 35 | 6. 76 |
| 5,000 | . 85 | . 99 | 1. 84 | . 54 | 1. 19 | 1. 73 | . 41 | 1. 49 | 1. 90 |
| 10,000 | . 84 | . 89 | 1. 78 | . 54 | . 88 | 1. 42 | . 41 | . 92 | 1. 33 |
| Improved layout: | | | | | | | | | |
| 1,000 | . 80 | 1. 93 | 2. 73 | . 50 | 4. 64 | 5. 14 | . 37 | 6. 32 | 6. 69 |
| 5,000 | . 80 | . 90 | 1. 70 | . 50 | 1. 16 | 1. 66 | . 37 | 1. 46 | 1. 83 |
| 10,000 | . 80 | . 80 | 1. 60 | . 50 | . 85 | 1. 35 | . 37 | . 89 | 1. 26 |

methods. This is because a more efficient utilization of relatively high-cost equipment is obtained in feedlots of this size. Furthermore, the labor requirements are lower. The same situation exists with respect to feedlots of a similar size with an improved layout.

The lowest cost method for feeding cattle in feedlots with a 1,000-head capacity and either a typical or an improved layout is the self-mixing self-unloading truck method. The lowest cost method for feedlots with a capacity for 5,000 head is the mixing-mill self-unloading truck method (mill capacity 40,000 pounds per hour). The lowest cost for feedlots with a capacity for 10,000 head is the mixing-mill self-unloading truck method (mill capacity 75,000 pounds per hour). Lower costs are obtained for feedlots of all sizes using comparable methods with an improved layout than with a typical layout, primarily because of the shorter travel distances.

Table 7 shows the lowest cost method for feedlots with an improved layout with capacities ranging from 1,000 to 10,000 head. It also shows at what capacity an operator should change to another method. For feedlots with capacities of from 1,000 to 4,000 head the self-mixing self-unloading truck method is the lowest cost method. For feedlots with a capacity for 5,000 to 7,000 head, the mixing-mill self-unloading truck (mill capacity 40,000 pounds per hour) is the lowest cost method. The lowest cost method for feedlots with a capacity for 8,000 to 10,000 head is the mixing-mill self-unloading truck method (mill capacity 75,000 pounds per hour).

TABLE 7.—*Labor and equipment costs per head for feeding cattle with an improved layout, by methods, and size of feedlot*

| Feedlot capacity | Self-mixing self-unloading truck method | | | Mixing mill self-unloading truck (mill capacity 40,000 pounds per hour) method | | | Mixing mill self-unloading truck (mill capacity 75,000 pounds per hour) method | | |
|---|---|---|---|---|---|---|---|---|---|
| | Labor costs | Equipment costs | Total | Labor costs | Equipment costs | Total | Labor costs | Equipment costs | Total |
| *Head* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* |
| 1,000 | 0. 80 | 1. 93 | 2. 73 | 0. 50 | 4. 64 | 5. 14 | | | |
| 2,000 | . 80 | 1. 25 | 2. 05 | . 50 | 2. 45 | 2. 95 | | | |
| 3,000 | . 80 | 1. 06 | 1. 86 | . 50 | 1. 70 | 2. 20 | | | |
| 4,000 | . 80 | . 94 | 1. 74 | . 50 | 1. 31 | 1. 81 | | | |
| 5,000 | . 80 | . 90 | 1. 70 | . 50 | 1. 16 | 1. 66 | 0. 37 | 1. 46 | 1. 83 |
| 6,000 | | | | . 50 | 1. 04 | 1. 54 | . 37 | 1. 27 | 1. 64 |
| 7,000 | | | | . 50 | . 95 | 1. 45 | . 37 | 1. 12 | 1. 49 |
| 8,000 | | | | . 50 | . 90 | 1. 40 | . 37 | 1. 01 | 1. 38 |
| 9,000 | | | | . 50 | . 87 | 1. 37 | . 37 | . 94 | 1. 31 |
| 10,000 | | | | . 50 | . 85 | 1. 35 | . 37 | . 89 | 1. 26 |

## Inspecting

Maintaining cattle in good health is mandatory in feedlots to minimize death losses and maximize the rate of gain. All feedlots inspect each animal daily so that sickness of any nature may be detected promptly and remedial measures be initiated as soon as possible. No equipment is used in performing the job. It involves a worker walking to each pen of cattle, going into the pen, and visually checking each animal for indications of sickness or injury. Those animals needing treatment are moved promptly to a hospital pen.

The average walking distances for the worker inspecting cattle in feedlots with a capacity for 1,000 head with a typical and an improved layout are 2,000 and 1,500 feet, respectively; for feedlots with a capacity for 5,000 head, 6,300 and 5,000 feet; and for feedlots with a capacity for 10,000 head, 10,500 and 8,300 feet.

The costs on a per-head basis for inspecting cattle remain relatively constant for all three sizes of feedlots with both a typical and an improved layout (table 8). However, costs are slightly lower for all three sizes of feedlots with an improved layout because the walking distances for the worker inspecting cattle are reduced. The reduction is greater for a feedlot with a capacity for 10,000 head than for feedlots of the other two sizes, because the walking distance is reduced more. The reduction in the inspecting cost for a feedlot with a capacity for 1,000 and 5,000 head is 2 cents per head. On an annual basis this would amount to $60 and $300, respectively. The reduction in cost for a feedlot with a capacity for 10,000 head is 3 cents per head. Annually, the reduction would amount to $900.

TABLE 8.—*Labor requirements and costs per head for inspecting cattle, by size of feedlot, for feedlots with a typical layout and an improved layout*

| Feedlot capacity | Requirements | |
|---|---|---|
| | Labor | Costs |
| *Head* | | |
| Typical layout: | *Man-hours* | *Dollars* |
| 1,000 | 0.10 | 0.13 |
| 5,000 | .10 | .13 |
| 10,000 | .10 | .13 |
| Improved layout: | | |
| 1,000 | .09 | .11 |
| 5,000 | .09 | .11 |
| 10,000 | .08 | .10 |

## Care of Sick and Injured Cattle

As previously stated, sick or injured animals are driven from the feeding pens to hospital pens where they are held until the disease or injury is cured. Routine diseases or injuries are cared for by the management. In the case of serious illness or injury a veterinarian is called. In the case of deaths the management disposes of the animals. Most feedlots estimate a 2-percent death loss over a period of years—the deaths may be caused by illness or animals may be killed because of serious injuries. Animals on the road to recovery are driven from hospital pens to a nearby exercise pen. Sick or injured animals are given attention as needed. Frequently, some animals are given attention twice a day. The common practice, however, is to attend to the animals once a day.

Feedlots with a capacity for 1,000 head estimate they are required to take care of 50 animals during a 120-day feeding period; feedlots with a 5,000-head capacity—250 animals; and feedlots with a capacity for 10,000 head—500 animals.

The amount of time given to sick or injured animals varies widely. The estimated labor requirements and costs for caring for sick or injured animals on a per-head basis, are the same for all sizes of feedlots, with or without an improved layout—0.05 man-hour and $0.06.

## Mounding Manure

Cleaning pens with cattle in them is a difficult and costly operation. Consequently pens are not cleaned until the cattle are shipped from the feedlot. As a result, pens are cleaned thoroughly only 3 times a year, based on an assumed 120-day feeding period. Periodically, however, manure on the floor of each pen is mounded in a central location in the pen (fig. 18). Mounding manure permits cattle to have a clean area in which to stand. Only one method of mounding manure was observed—a worker performing the job with a tractor with a blade attached to it. Feedlots

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FIGURE 18.—Manure mounded in a pen.

with a capacity for 1,000 and 5,000 head use only one tractor with a blade attachment in mounding manure, while feedlots with a capacity for 10,000 head use two.

The labor and equipment requirements and costs per head for mounding manure by size of feedlot for feedlots with the typical and the improved layout are shown in table 9.

TABLE 9.—*Labor and equipment requirements and costs per head for mounding manure in pens, by capacity of feedlots; typical layout or improved layout*

| Feedlot capacity | Requirements | | Costs | | |
|---|---|---|---|---|---|
| | Labor | Equipment | Labor | Equipment | Total |
| *Head* | *Man-hours* | *Machine-hours* | *Dollars* | *Dollars* | *Dollars* |
| 1,000 | 0. 03 | 0. 03 | 0. 04 | 0. 11 | 0. 15 |
| 5,000 | . 03 | . 03 | . 04 | . 05 | . 09 |
| 10,000 | . 03 | . 03 | . 04 | . 05 | . 09 |

The costs are the same for feedlots of comparable sizes with either a typical or an improved layout. Costs are lower for feedlots of the larger sizes, although they are required to have more equipment, because better use of equipment is made.

## Loading Out Cattle

Loading out cattle involves driving the cattle from feeding pen to the working alley. Cattle may or may not be sorted by size, sex, class, color, and condition in the alley and driven into catch pens. From the catch pens they are driven onto the scale platform, weighed, and driven from the platform into the chute pen. From the chute pen they are loaded onto trucks. The equipment involved in the operation is a scale and scale platform (weighing capacity 20,000 pounds). The average work crew for loading out consists of two workers.

The labor cost for loading out cattle increases as the size of the feedlot increases, for feedlots with a typical or improved layout. The increase is because in the larger feedlots longer drives are required, and more labor is needed. Correspondingly, the equipment cost decreases as the size of the feedlots increases because the equipment is more fully utilized. Costs for loading out are lower for feedlots with an improved layout than with typical layouts. All of the reduction in costs is in the cost of labor and is the result of shorter driving distances.

The average driving distances on feedlots with a capacity for 1,000 head and with a typical layout is 550 feet, compared to 400 feet for feedlots with an improved layout; for feedlots with a 5,000-head capacity, 1,000 feet, compared to 750 feet; and for feedlots with a capacity for 10,000 head, 1,600 feet, compared to 1,000 feet.

An improved layout for a feedlot with a capacity for 1,000 head reduces the driving distances for loading out cattle 27 percent, and the cost 15 percent (table 10). The actual reduction in costs amounts to 2 cents a head, or $60 annually. An improved layout for a feedlot with a capacity for 5,000 head reduces the driving distance 25 percent and the cost 27 percent. The reduction in cost is 3 cents per head, or $450 a year. For an improved feedlot layout with a capacity for 10,000 head, driving distance is reduced 37 percent, and cost 36 percent. Costs are reduced 5 cents a head or $1,500 annually.

TABLE 10.—*Labor and equipment requirements and costs per head for loading out cattle by feedlot capacity for feedlots with a typical layout and an improved layout*

| Feedlot capacity | Requirements | | Costs | | |
|---|---|---|---|---|---|
| | Labor | Equipment | Labor | Equipment | Total |
| *Head* | | | | | |
| Typical layout: | *Man-hours* | *Machine-hours* | *Dollars* | *Dollars* | *Dollars* |
| 1,000 | 0. 05 | 0. 01 | 0. 06 | 0. 07 | 0. 13 |
| 5,000 | . 07 | . 01 | . 09 | . 02 | . 11 |
| 10,000 | . 10 | . 01 | . 13 | . 01 | . 14 |
| Improved layout: | | | | | |
| 1,000 | . 03 | . 01 | . 04 | . 07 | . 11 |
| 5,000 | . 05 | . 01 | . 06 | . 02 | . 08 |
| 10,000 | . 06 | . 01 | . 08 | . 01 | . 09 |

## Cleaning Pens

As previously pointed out, it is assumed that pens are cleaned three times each year. In cleaning pens the manure is scooped from the pen floor with a front-end loader attached to a tractor, dumped into the bed of a truck, and hauled to a predetermined location near the feedlot. The front-end loader is a scoop about 4 or 5 feet wide and 15 inches deep (fig. 19). The truck is a 4-wheel dump truck. Feedlots with a 1,000-head capacity use one tractor with a front-end loader attached and one truck; 5,000-head capacity feedlots use one tractor and two trucks; and 10,000-head capacity feedlots use two tractors and four trucks. The average load hauled from the pens is 7,000 pounds.

The transport distances for hauling manure from the pens in cleaning vary with the size of feedlots and for feedlots with a typical layout and an improved layout. For feedlots with a capacity for 1,000 head and with a typical layout the transport distance is 800 feet—with an

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FIGURE 19.—A tractor with a front-end loader for cleaning pens.

improved layout, 650 feet; for feedlots with a 5,000-head capacity and a typical layout, 1,800 feet—with an improved layout, 1,200 feet; and for feedlots with a 10,000-head capacity and a typical layout, 3,000 feet—with an improved layout, 1,700 feet.

Pens are cleaned after the lot of cattle has been removed and before the next lot is driven to the pen. With this irregular or periodic operation there is no assigned crew for cleaning. Workers are assembled from other job assignments when a pen or pens are ready for cleaning. The feedlot with a capacity for 1,000 cattle uses only one worker to clean a pen. The worker loads the cleaning truck, drives to the manure dump, empties the truck, and returns to the empty pen to load the truck again. The same system is used for the 5,000 and 10,000-head feedlots; however, the transporting distance for the truck and the workload for cleaning necessitates the use of two dump trucks for each tractor.

The labor and equipment requirements and cost per head for cleaning pens in the typical and improved layouts for 1,000- 5,000- and 10,000-head capacities are shown in table 11. Cleaning costs are reduced 4 cents per head for feedlots with a capacity of 1,000 head. Annually this would amount to $120. The comparable reduction on the 5,000-head capacity feedlot is 1 cent per head or $150 annually, and 4 cents per head or $1,200 annually for the 10,000-head capacity feedlot.

## Summary of Feedlot Operations

An improved layout, equipment, and work methods can reduce the cost of performing operations in feedlots with a capacity for 1,000 head, 5,000 head, and 10,000 head (table 12). Some reduction occurs in all operations except caring for sick or injured cattle and mounding manure.

The cost for performing feedlot operations in a feedlot with a capacity for 1,000 head with a typical layout is $4.60 per head as compared with $4.17 for a feedlot with an improved layout. Feedlots of this size use the self-mixing self-unloading truck method of feeding cattle. The reduction in labor cost is due to an improved arrangement of facilities which provides for shorter distances of travel in performing feeding operations. The total travel distance for performing feedlot operations with an improved layout is 24 percent less than with a typical layout (table 13). Equipment costs are also reduced because a rearrangement of facilities permits the weighing of feed to be performed with one scale and scale platform.

TABLE 11.—*Labor and equipment requirements and costs per head for cleaning pens, by capacity of feedlot*

| Feedlot capacity | Requirements | | Costs | | |
|---|---|---|---|---|---|
| | Labor | Equipment | Labor | Equipment | Total |
| | *Head* | | | | |
| Typical layout: | *Man-hours* | *Machine-hours* | *Dollars* | *Dollars* | *Dollars* |
| 1,000 | 0.09 | 0.18 | 0.11 | 0.65 | 0.76 |
| 5,000 | .12 | .18 | .15 | .29 | .44 |
| 10,000 | .13 | .20 | .16 | .31 | .47 |
| Improved layout: | | | | | |
| 1,000 | .08 | .16 | .10 | .62 | .72 |
| 5,000 | .12 | .18 | .15 | .28 | .43 |
| 10,000 | .12 | .18 | .15 | .28 | .43 |

The reduction in cost with an improved layout is 43 cents per head. Based on the assumption that the feedlot would handle 3,000 cattle a year the annual savings would amount to $1,290.

The cost for performing feeding operations in a feedlot with a capacity for 5,000 head and with a typical layout is $2.84 per head as compared with $2.67 for a feedlot with an improved layout. Feedlots with both types of layouts use the mixing-mill self-unloading truck method (mill capacity 40,000 pounds per hour) for feeding cattle. Part of the reduction in cost for feedlots of this size with an improved layout is in the labor and part in equipment. The reduction in both is the result of shorter travel distances. Travel distances are reduced 24 percent for a feedlot of this size.

The reduction in cost with an improved layout amounts to 17 cents per head. Based on the assumption that the feedlot would handle 15,000 cattle per year, the annual savings would amount to $2,550 annually.

The cost for performing feeding operations in a feedlot with a capacity for 10,000 head with a typical layout is $2.52 as compared to $2.25 in a feedlot with an improved layout. The reduction in costs is in the same operations and for the same reasons as those listed for a feedlot with a capac-

TABLE 12.—*Labor and equipment requirements and costs per head for performing feedlot operations with a typical layout and improved layout, by capacity of feedlot*

| Operation | 1,000-head capacity | | | | | 5,000-head capacity | | | | | 10,000-head capacity | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Requirements | | Costs | | | Requirements | | Costs | | | Requirements | | Costs | | |
| | Labor | Equipment | Labor | Equipment | Total | Labor | Equipment | Labor | Equipment | Total | Labor | Equipment | Labor | Equipment | Total |
| | *Man-hours* | *Machine-hours* | *Dollars* | *Dollars* | *Dollars* | *Man-hours* | *Machine-hours* | *Dollars* | *Dollars* | *Dollars* | *Man-hours* | *Machine-hours* | *Dollars* | *Dollars* | *Dollars* |
| Typical layout: | | | | | | | | | | | | | | | |
| Receiving cattle | 0.11 | 0.01 | 0.14 | 0.07 | 0.21 | 0.13 | 0.01 | 0.16 | 0.02 | 0.18 | 0.16 | 0.01 | 0.20 | 0.01 | 0.21 |
| Preparing feed orders | .11 | | .14 | | .14 | .08 | | .10 | | .10 | .07 | | .09 | | .09 |
| Feeding cattle | .70 | 1.98 | .88 | 2.14 | 3.02 | .37 | .28 | .54 | 1.19 | 1.73 | .29 | .24 | .41 | .92 | 1.33 |
| Daily inspection of cattle | .10 | | .13 | | .13 | .10 | | .13 | | .13 | .10 | | .13 | | .13 |
| Care of sick or injured cattle | .05 | | .06 | | .06 | .05 | | .06 | | .06 | .05 | | .06 | | .06 |
| Mounding manure | .03 | .03 | .04 | .11 | .15 | .03 | .03 | .04 | .05 | .09 | .03 | .03 | .14 | .05 | .09 |
| Loading out cattle | .05 | .01 | .06 | .07 | .13 | .07 | .01 | .09 | .02 | .11 | .10 | .01 | .13 | .01 | .14 |
| Cleaning pens | .09 | .18 | .11 | .65 | .76 | .12 | .18 | .15 | .29 | .44 | .13 | .20 | .16 | .31 | .47 |
| Total | 1.24 | 2.21 | 1.56 | 3.04 | 4.60 | 0.95 | 0.51 | 1.27 | 1.57 | 2.84 | 0.93 | 0.49 | 1.22 | 1.30 | 2.52 |
| Improved layout | | | | | | | | | | | | | | | |
| Receiving cattle | 0.99 | 0.01 | 0.11 | 0.07 | 0.18 | 0.11 | 0.01 | 0.14 | 0.02 | 0.16 | 0.12 | 0.01 | 0.15 | 0.01 | 0.16 |
| Preparing feed orders | .09 | | .11 | | .11 | .06 | | .08 | | .08 | .05 | | .06 | | .06 |
| Feeding cattle | .64 | 1.91 | .80 | 1.93 | 2.73 | .34 | .25 | .50 | 1.16 | 1.66 | .26 | .21 | .37 | .89 | 1.26 |
| Daily inspection of cattle | .09 | | .11 | | .11 | .09 | | .11 | | .11 | .08 | | .10 | | .10 |
| Care of sick or injured cattle | .05 | | .06 | | .06 | .05 | | .06 | | .06 | .05 | | .06 | | .06 |
| Mounding manure | .03 | .03 | .04 | .11 | .15 | .03 | .03 | .04 | .05 | .09 | .03 | .03 | .04 | .05 | .09 |
| Loading out cattle | .03 | .01 | .04 | .07 | .11 | .05 | .01 | .06 | .02 | .08 | .06 | .01 | .08 | .01 | .09 |
| Cleaning pens | .08 | .16 | .10 | .62 | .72 | .12 | .18 | .15 | .28 | .43 | .12 | .18 | .15 | .28 | .43 |
| Total | 1.10 | 2.12 | 1.37 | 2.80 | 4.17 | 0.85 | 0.48 | 1.14 | 1.53 | 2.67 | 0.77 | 0.44 | 1.01 | 1.24 | 2.25 |

TABLE 13.—*Travel distances for performing specific operations in feedlots with a typical layout and an improved layout, by capacity of feedlot*

| Operation | Feedlot capacity | | | | | |
|---|---|---|---|---|---|---|
| | 1,000-head | | 5,000-head | | 10,000-head | |
| | Travel distance | | Travel distance | | Travel distance | |
| | Typical layout | Improved layout | Typical layout | Improved layout | Typical layout | Improved layout |
| | *Feet* | *Feet* | *Feet* | *Feet* | *Feet* | *Feet* |
| Receiving | 550 | 400 | 1, 000 | 750 | 1, 600 | 1, 000 |
| Preparing feed orders | 1, 900 | 1, 400 | 6, 000 | 4, 700 | 10, 000 | 7, 800 |
| Feeding | 800 | 650 | 1, 800 | 1, 200 | 3, 000 | 1, 700 |
| Inspecting | 2, 000 | 1, 500 | 6, 300 | 5, 000 | 10, 500 | 8, 300 |
| Loading out | 550 | 400 | 1, 000 | 750 | 1, 600 | 1, 000 |
| Cleaning pens | 900 | 750 | 2, 000 | 1, 400 | 3, 300 | 2, 000 |
| | 6, 700 | 5, 100 | 18, 100 | 13, 800 | 30, 000 | 21, 800 |

ity for 5,000 head. Travel distances are 27 percent less with an improved layout in feedlots of this size. The reduction in costs amounts to 27 cents per head. Based on the assumption that the feedlot would handle 30,000 cattle per year the annual savings would amount to $8,100.

The total costs for performing feedlot operations in feedlots with an improved layout and with capacities for 1,000; 5,000; and 10,000 head are $4.17, $2.67, and $2.25 per head respectively. The reduction in the cost of performing feedlot operations by size of feedlot is due partly to the method employed and partly to shorter travel distances. In feedlots with a capacity for 1,000 head the self-mixing self-unloading truck method is used for feeding cattle; feedlots with a capacity for 5,000 head use the mixing-mill self-unloading feed truck (mill capacity 40,000 pounds per hour) method; and feedlots with a capacity for 10,000 head use the mixing-mill self-unloading feed truck (mill capacity 75,000 pounds per hour) method. The equipment cost-volume relationship is a major factor contributing to a decrease in operating costs with an increase in volume.

## SUGGESTED LAYOUTS FOR CATTLE FEEDLOTS

In developing principles and criteria for use in planning improved facilities for commercial cattle feedlots the primary objectives are: (1) To provide the kind and amount of facilities needed that will maximize the rate of gain and minimize losses from sickness and injury; (2) to develop an arrangement of facilities that will minimize the amount of labor required for receiving, preparing feed orders, feeding, inspecting, cleaning pens, and loading out cattle; and (3) to select the type of facilities and equipment for feeding that will result in the lowest feeding cost in relation to the volume of animals fed. The attainment of these objectives should, of course, correct the defects noted in existing feedlots.

The plans for commercial cattle feedlots presented in this section are intended to illustrate only the principles of layout, design, and size in relation to volume fed. These plans are not suggested for any specific feedlot or locality.

For the purpose of illustrating the principles of commercial cattle feedlot layouts, feedlots of three sizes are selected. One would have a capacity for 1,000 head, one for 5,000 head, and the other for 10,000 head. Based on a 120-day feeding period these feedlots could feed 3,000; 15,000; and 30,000 cattle, respectively, a year.

### Layout Designed to Handle 1,000 Head

The type and amount of facilities needed for a commercial cattle feedlot with a capacity for 1,000 head, the arrangement of facilities, expansion of facilities, and the amount of land needed for a feedlot site are discussed below.

#### Facilities Needed

The major types of facilities needed are: (1) Facilities for receiving and loading out cattle; (2) pens; (3) alleys; (4) feeding facilities; (5) equipment barn; (6) fencing; (7) watering facilities; (8) management's office; (9) parking area; and, (10) others such as windbreaks and shade.

##### Receiving and Loading Out Cattle

The facilities used for receiving cattle consist of a truck dock; scale, scale house, and scale plat-

form; and a working alley and catch pens. All the facilities except the catch pens are used regularly in loading out cattle. The catch pens are used for loading out only when cattle are sorted before being loaded onto trucks.

Truck Dock.—The truck dock includes the dock platform, the chute, and chute pen. The number and type of truck docks needed should be based on the number and type of trucks hauling cattle to and from the feedlot. On a feedlot of the size under consideration rarely is there more than one truckload of cattle being received or loaded at one time. Furthermore, practically all the cattle are received or loaded onto tractor trailer trucks. Thus only one dock is suggested. The platform of the dock should be 3 feet wide and 8 feet long. It should be 50 inches high. The chute suggested is the step type—it is 6 feet wide and 10 feet long.[1] Cattle move up and down this type of chute with less hesitation than they move up and down the ramp type. The suggested chute pen for holding cattle temporarily before weighing is approximately 10 feet square.

Scale House, Scale, and Scale Platform.—The proposed scale house is 3 feet wide and 5 feet long. It provides space for the weigh beam, a worker for performing the weighing operations, and storage space for forms and records. The scale house parallels the scale platform. The scale platform is 10 feet wide and 34 feet long, large enough to weigh 30 comparatively lightweight animals or 20 relatively large animals at one time. The scale should be the weigh-beam type with a 20,000-pound capacity, and a 5-pound minimum graduation.

Working Alley and Catch Pens.—A working alley and 4 catch pens are suggested for the feedlot. The working alley is 10 feet wide and 80 feet long, and is for vaccinating, branding, worming, castrating, or dehorning cattle. A squeeze chute should be located in the alley so that animals may be held singly while any of the operations are being performed on them.

Four catch pens of variable sizes—one 20 feet square, one 20 feet wide and 22 feet long, one 20 feet wide and 25 feet long, and one 16 feet wide and 32 feet long—should be located adjacent to the working alley. Each pen should have a 10-foot gate opening into the alley. The catch pens are for holding treated animals, animals of different classes, or an owner's lot temporarily.

### Pens

Pen facilities consist of pens for feeding cattle (including feedbunks), hospital pens, and a runaround pen. Hospital pens are for sick or injured cattle; the runaround pen is for recuperating animals or animals under observation.

Pens for Feeding Cattle.—The number, size, and type of feeding pens needed are directly related to or dependent on such factors as: (1) Volume fed; (2) number of different owners' lots fed; (3) size of lots fed; (4) number of different type rations fed; (5) pattern of receipts; and (6) pen space utilization and bunk space requirements.

Studies of feedlots of this size show that the typical feedlot feeds the cattle of 12 different owners, and that one-third of the owners use one pen, and two-thirds use 2 pens. Based on the results of this study, a feedlot with a capacity of 1,000 head would need 20 pens. The need for two pens by an owner may be due to the size of the lot he is feeding, or it may be that he has two lots, each being fed a different type of ration. The difference in rations may be due to the time of arrival of the cattle on the feedlot. The sizes of the lots fed, which is a major factor in determining pen sizes, are extremely variable, ranging from 25 head to 100 head. The number of small lots fed in feedlots of this size are usually about twice as great as the number of medium or large lots. Thus, 10 pens, each with a capacity for 25 cattle, 5 pens each with a capacity for 50 cattle, and 5 pens each with a capacity for 100 head, are suggested for the feedlot.

The suggested pen space allowance per head is 200 square feet. This allowance is based on a dirt floor for pens. The allowance includes provisions for 18 inches of bunk space per head, watering facilities, and also allows for mounding manure. Based on the number of pens needed for feeding individual owner's lots and the pen space allowance per head, a pen area of 204,300 square feet is suggested. Nine pens 70 feet by 70 feet and one pen 50 feet by 100 feet are suggested for feeding lots of 25 head, 3 pens 100 feet by 100 feet and two triangle-shaped pens in an area 140 feet by 150 feet for lots of 50 head, and 4 pens 130 feet by 160 feet and one pen 140 feet by 150 feet for lots of 100 head. Pen floors should have adequate slope for drainage—a 3- or 4-percent slope.

Feeding pen fences should be of ½-inch steel cable, 54 inches high. Posts should be of 2-inch pipe and spaced 12 feet apart. Five strands should be used on three sides and two strands on the feed bunk side. The lower strand of cable should be about 6 inches above the ground and the other four strands should be spaced at 8-, 10-, 12- and 14-inch intervals. The two strands above the feed bunk should be spaced equal distances apart.

The feed bunk forms part of the fence for this side of the pen, and is located to permit feed to be augered into the bunk without the interference of posts. The feed bunk should be constructed of concrete (fig. 20), with the alley side of the bunk 20 inches high and the fence-line side 12 inches high. The low side along the fence line enables cattle to feed better. The high side adja-

[1] U.S. Dept. Agr. Mktg. Res. Rpt. 141. Livestock Auction Markets in the Southeast—Methods and Facilities. 99 pp., illus. 1956.

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FIGURE 20.—A concrete feed bunk for cattle.

cent to the alley makes the feeding operation easy and prevents feed waste. The bottom of the bunk should be rounded and about 18 inches wide.

A concrete platform 7 feet wide and 6 inches thick should extend from the feed bunk into the pen to provide solid footing for the cattle while eating and to prevent the cattle from chopping up ground and digging holes in the ground around the feed bunks.

HOSPITAL PENS.—Four hospital pens 10 feet by 10 feet are suggested for the feedlot. These pens should be adequate to provide for the number of sick or injured animals during a 120-day feeding period. These pens would be constructed in a manner similar to the feeding pens. However, the hospital pens should have a roof to afford maximum protection to indisposed animals. The floor of the pens should have adequate slope so that it will drain properly.

RUNAROUND PEN.—One pen 20 feet by 30 feet is suggested for a runaround pen. This pen would be used by recuperating animals as an exercise pen. If the occasion demands, and the pen is available, it can also be used as a hospital pen. The pen would be of the same construction as the feeding pens. The floor of this pen also should have adequate slope to provide for proper drainage.

### Alleys

Alleys should be of sufficient width to expedite the movement of groups of cattle into and out of the feedlot and to permit the use of trucks in hauling feed to pens and for cleaning pens. With the exception of the working alley, and the alley leading to the hospital pens, feed and drive alleys should be 20 feet wide. The suggested width of the working alley and the alley to the hospital pen is 10 feet. Trucks do not use these alleys for feeding. At the intersection of main alleys, feeding pen corners should be rounded to provide trucks ample space for turning.

### Feeding Facilities

For a commercial feedlot with a capacity for 1,000 head the self-mixing self-unloading feed truck method is suggested for feeding cattle. This method is the lowest cost method for feedlots of this size. The facilities for feeding with this method include a feed barn and a trench silo.

FEED BARN.—The feed barn consists of two buildings separated by a scale platform. One of the buildings is 23 feet wide, 40 feet deep, and 25 feet high. This building is for storing grain; within the building there should be a bin with a hopper-type bottom. The bin would have a storage capacity for 13,600 bushels of grain. Based on feeding 24 pounds of grain per head per day, the feedlot would have a storage capacity for a month's supply of grain.

The area occupied by the scale platform is 16 feet wide and 40 feet deep. The suggested scale platform is 10 feet wide and 34 feet long. Thus adequate work space is provided on either side of the scale platform for workers. The area occupied by the scale platform should be covered by a roof to provide protection to the scale from inclement weather. It also would provide protection to the feed and workers loading feed onto trucks.

The second building is 16 feet wide, 40 feet deep, and 10 feet high. It is divided into three compartments. One compartment is 16 feet wide and 15 feet deep and would be used for storing pellets and a pellet auger with hopper. The compartment contains 240 square feet. An area 4 feet deep and 16 feet long would be used for storing a month's supply of pellets or about 150 100-pound bags. The remainder of the space would be taken up by the pellet auger with hopper and work space.

The other feed compartment is 16 feet wide and 10 feet deep and is for storing silage. It also provides space for a silage conveyor. The space should be adequate for storing 6,000 pounds of silage, the size of the load usually hauled to the compartment.

The other compartment is for management's office.

TRENCH SILO.—On the feedlots that were studied, cattle were fed an average of 5 pounds of silage per head per day. Based on feeding 3,000 cattle annually, a feedlot would need storage for 900 tons. Thus a trench silo 40 feet wide, 80 feet long, and 17 feet deep is suggested for the proposed feedlot. A trench silo of this size would provide storage space for 954 tons of silage.

### Equipment Barn

An equipment barn is suggested for storing two feed trucks, a tractor, a silage loader, a dump truck, and miscellaneous items such as spare parts. The barn also would be used for repairing equipment. An equipment barn 30 feet wide and 60 feet long should be adequate.

### Feedlot Fencing

A fence is suggested around all feedlot facilities as an extra protection to animals that might escape from their pens and to keep unauthorized people from the premises. The suggested fence should be of the same height and construction as that proposed for the feeding pens. The fence should be connected directly in front of the facilities proper by a 12-foot cattle guard. The total length of the fence suggested is 2,338 feet.

### Water Tanks

Automatic waterers should be provided in each feeding pen.

In those areas where freezing is a problem, heat is provided by a reflector heat bulb. The bulb screws into a socket under the bottom in the center of the automatic water tank. The heat bulb works on a thermostat and comes on when the temperature drops below 33° F. It automatically cuts off when the temperature goes above 33° F.

### Management's Office

As previously stated, management's office occupies one compartment of a building used for storing feed. The office is 16 feet wide and 15 feet deep. It contains 240 square feet and provides space for a desk, filing cabinets, and toilet facilities.

### Parking Area

A parking area is suggested for vehicles of employees of the feedlot and for feedlot patrons. The number of employees on feedlots with the capacity for 1,000 head is comparatively small, ranging from 4 to 6 people. Furthermore, only a few patrons are usually at the feedlot at one time. Thus the number of parking spaces needed would be comparatively small. A total of 8 spaces, 12 feet wide and 30 feet deep, are suggested.

### Other Facilities

Depending on the location of the feedlot and the prevailing weather, windbreaks or shades are provided for the health and comfort of the cattle.

Windbreaks.—In areas where inclement weather is a problem, windbreaks are provided on the appropriate side to protect animals from wind and blowing snow. The windbreak should be constructed of rough lumber 12 inches wide and about 7 feet high.

Shade.—Shades are needed in those areas of the country having high summer temperatures. The shade covers an area about 12 feet wide down the length of the pen. The shades generally consist of wire-bound, wooden picket-type fencing. These pickets are approximately ½ inch thick, 2 inches wide, and 3 feet long.

## Arrangement of Facilities

A suggested layout for the feedlot with a capacity for 1,000 head which brings together the various components previously discussed is shown in figure 21. Of primary importance in the arrangement or grouping of facilities on a commercial feedlot are the distances of travel involved in receiving, preparing feed orders, feeding, inspecting, loading out, and cleaning pens. An ideal arrangement of facilities would be one where the focal point of all feedlot activities would be in the center or as near the center of the feedlot as possible. Such a location would insure a minimum distance of travel for workers performing specific operations.

In the proposed layout the components are grouped into a compact U-shaped area. The facilities for receiving and loading out cattle, feeding facilities, and the equipment barn are located near the center of the U. These facilities are the focal point of all feedlot activities. Feed is hauled from the feed barn to the feed bunks, cattle are received and loaded out at the truck dock, the worker preparing feed orders and inspecting cattle has his office in a section of the feed barn, and cleaning equipment is stored in the equipment barn. A trench silo for storing silage is located at the mouth of the U.

Pen facilities are located on three sides of the focal point. The fourth side of the feedlot is kept open to provide for a free flow of livestock, feed, market patrons, and visitors to and from the feedlot. This side should connect with a public road.

All the feeding pens should be numbered. The pen number is the control item for all operations and also serves as the identification of different owners' animals.

One load of feed is delivered to each pen in the feedlot. Therefore pens for the smallest size lots are located as near the focal point or feed barn as possible in order to minimize total travel distances in feeding.

Twenty-foot feed and drive alleys separating rows of feeding pens are arranged so that feed trucks can turn at intersections without going to the end of an alley. Therefore, when feed trucks empty their loads they can return to the loading station with a minimum distance of travel.

## Expansion of Facilities

To expand or increase the size of the feedlot, additional feeding pens, and feed and drive alleys would be constructed on each side and to the rear of the present pens. This would increase both the depth and width of the feedlot. However, the focal point of all feedlot activities would remain near the center of the feedlot. In line with the policy of maintaining the smallest feed pens nearest the facilities for feeding, it is suggested that a feed and drive alley be cut through pen

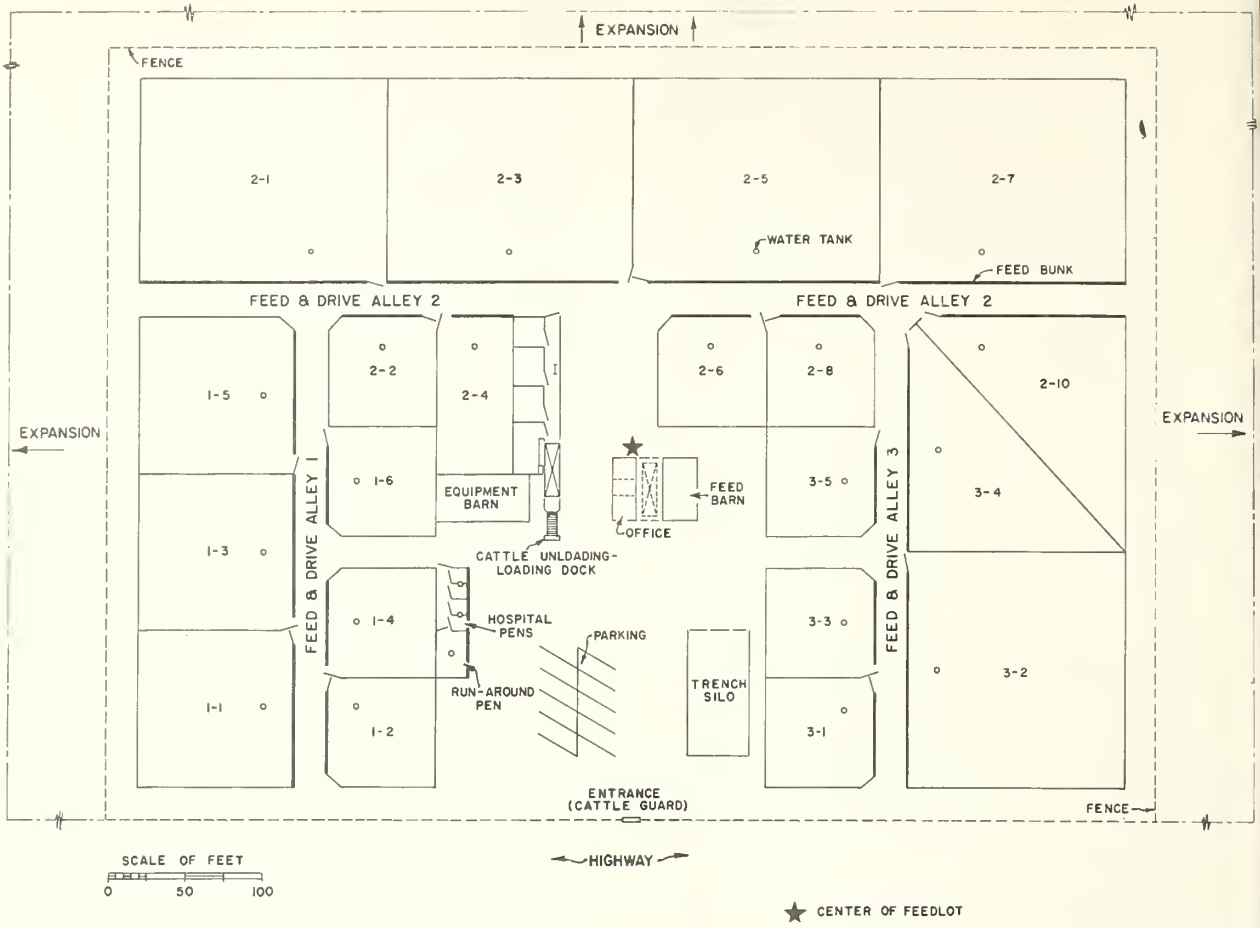


FIGURE 21.—Proposed layout for a commercial cattle feedlot with a capacity for 1,000 head.

No. 2–5 and that the remainder of pen No. 2–5 and pen No. 2–3 be divided into smaller pens. The type of division made for pen No. 2–5 would also be made to pens Nos. 3–2 and 1–3 if the expansion should warrant it. Large pens would be the new pens constructed. The suggested expansion would maintain the same flow lines originally planned.

More hospital pens and a runaround pen could be added by extending the present fence along pen No. 1–2. Facilities for receiving and loading out cattle could be increased by adding another row of catch pens opposite the present catch pens.

Adequate space is provided in the suggested layout for expanding current facilities used for feeding livestock or even removing current facilities and replacing them with mill facilities.

### Amount of Land Needed

The layout of the feedlot with a capacity for 1,000 head shown in figure 21, is 680 feet wide and 495 feet deep. It contains 7.7 acres. Thus a feedlot site of this size and of these dimensions would be adequate at the outset. However, commercial feedlots, particularly of this size, have shown a tendency to grow. Thus it is suggested that at the outset the site be of adequate size to provide for future expansion. Based on an assumed expansion to a capacity for 5,000 head an area 1,325 feet wide and 986 feet deep would be needed. Such an area would contain approximately 30 acres. To obtain the necessary depth and width required, in some instances, may necessitate the buying of more acreage than is needed.

## Layout Designed to Handle 5,000 Head

The major types of facilities needed for a commercial feedlot designed to handle 5,000 head are the same as those listed for a commercial cattle feedlot designed to handle 1,000 head. However the kind and amount of facilities needed and their arrangement differ to some extent.

### Facilities Needed

#### Receiving and Loading Out Cattle

The same types and kinds of facilities suggested for receiving and loading out cattle for a

feedlot designed to handle 1,000 head also are suggested for a feedlot designed to handle 5,000 head. However, 10 catch pens are suggested for a feedlot of this size because of the greater volume it would handle. Only one truck dock, a scale house, scale and scale platform, and one working alley are suggested.

Eight of the 10 catch pens suggested are 20 feet by 22 feet in size, and 2 catch pens are approximately 20 feet by 55 feet. Four of the small pens and one large one are located on one side of the working alley and the same number of pens are located on the other side. A 10-foot gate in each pen opens onto the alley. The working alley is 10 feet wide.

### Pens

The criteria for determining the number, size, and types of pens needed for a feedlot with a capacity for 1,000 head is also applicable to a feedlot with a capacity for 5,000 head.

Pens for Feeding Cattle.—Studies of cattle feeding on feedlots with a capacity for 5,000 head show that the typical feedlot feeds the cattle of 28 owners, and that 11 owners use 1 pen; 14 owners, 2 pens; and 3 owners, 3 pens. In addition, the management of the feedlot attempts to keep a small number of pens open for trial pens. Trial pens are uncommitted pens, for which the management hopes to obtain new business. Three trial pens are suggested for the layout. Thus a total of 51 pens is suggested for the proposed feedlot. The sizes of the lots of cattle fed on feedlots of this size range from 25 head to 300 head. The typical feedlot of this size usually feeds 12 lots of 25 head, 12 lots of 50 head, 16 lots of 100 head, 8 lots of 200 head, and 3 lots of 300 head. Thus, pens are suggested for the proposed layout for these size lots.

Twelve pens 70 feet by 70 feet are suggested for feeding lots of 25 head, 12 pens 100 feet by 100 feet for lots of 50 head, 16 pens 130 feet by 150 feet for lots of 100 head, 6 pens 130 feet by 300 feet and 2 pens 130 feet by 310 feet for lots of 200 head, and 3 pens 130 feet by 430 feet for lots of 300 head. The total pen space proposed amounts to 973,100 square feet.

The feed bunks, the concrete platform extending from the bunks, and fences for these pens would be of the same design as those suggested for the proposed feedlot with a capacity for 1,000 head.

Hospital Pens.—Twelve hospital pens are suggested. Ten pens are 10 feet by 10 feet and are for holding one or two animals. Two pens are 20 feet by 30 feet and are for holding small groups.

Runaround Pens.—Two runaround pens are suggested. One pen is 100 feet by 130 feet and the other is 125 feet by 130 feet.

### Alleys

The width of the feed and drive alleys suggested for this feedlot is the same as that suggested for the feedlot with a capacity for 1,000 head.

### Feeding Facilities

For a feedlot with a capacity for 5,000 head, the mixing-mill self-unloading truck method (mill capacity 40,000 pounds per hour) of feeding is suggested, because it is the lowest cost method. The components for the mill previously have been described. The building for the mill proper is 60 feet by 100 feet. Adjacent to the building is the scale and scale platform for weighing feed.

Also adjacent to the building for the feed mill proper is an office building, 20 feet by 30 feet, for management. A silage pit about 10 feet wide and 16 feet long is located adjacent to the office building and the building for the mill proper. The pit should be equipped with a silage drag, and have a capacity for about 5 tons of silage. Four upright silos are suggested for storing feed. Three of the silos have a 30-foot diameter and are 40 feet high. Each has the storage capacity for about 22,500 bushels. The total storage capacity for grain is 67,500 bushels. Based on feeding 5,000 cattle daily, an average of 24 pounds, the upright silos provide adequate storage for a 30-day supply. The other silo has a 20-foot diameter and is 30 feet high. This silo has the storage capacity for 7,000 bushels of pellets.

Based on feeding 15,000 cattle annually at the rate of 5 pounds of silage per day, storage for 4,500 tons of silage would be needed for the feedlot. Thus two trench silos, each 55 feet by 120 feet and with a depth of 20 feet, are suggested for storing silage. The two silos have a storage capacity for 4,640 tons.

### Equipment Barn

The equipment barn suggested would be used for the same purposes as those described for a feedlot with a capacity for 1,000 head. The equipment barn would house two feed trucks, a silage truck, a silage loader, a tractor, and two dump trucks. It would also provide space for storing spare equipment parts and repairing trucks. The suggested barn is 30 feet by 100 feet.

### Feedlot Fencing

A fence is suggested around all feedlot facilities for the same reasons as those given in the preceding section. The fencing needed is 4,958 feet, and should be located 20 feet from the facilities proper.

### Water Tanks

Automatic water tanks are suggested for each pen. The water tanks would be the same as those suggested for a feedlot with a capacity for 1,000 head.

### Management's Office

Management's office is adjacent to the feed mill. It is 30 feet long and 20 feet wide, and comprises 600 square feet. Space is provided for a general office, a private office for the manager, and toilet facilities.

### Parking Area

A parking area is suggested for vehicles of employees of the feedlot and for feedlot patrons. The number of employees on feedlots with a capacity for 5,000 head range from 7 to 10 people. Furthermore, only a few patrons are usually on the feedlot at one time. Thus the number of parking spaces needed would be small. A total of 14 spaces, 12 feet wide and 30 feet deep, are suggested.

### Other Facilities

The other facilities would be similar to those suggested for the feedlot with a capacity for 1,000 head.

## Arrangement of Facilities

A suggested layout with a capacity for 5,000 head which brings together the various components previously discussed is shown in figure 22. The principles involved in the arrangement of the various components for this feedlot are the same as those given for a feedlot with a capacity for 1,000 head. With minor deviation, the components for this feedlot also are arranged similarly.

## Expansion of Facilities

To expand or increase the size of the feedlot, additional feeding pens and drive alleys would be constructed on each side and to the rear of the present pens. This would increase both the depth and width of the feedlot; however, the fo-

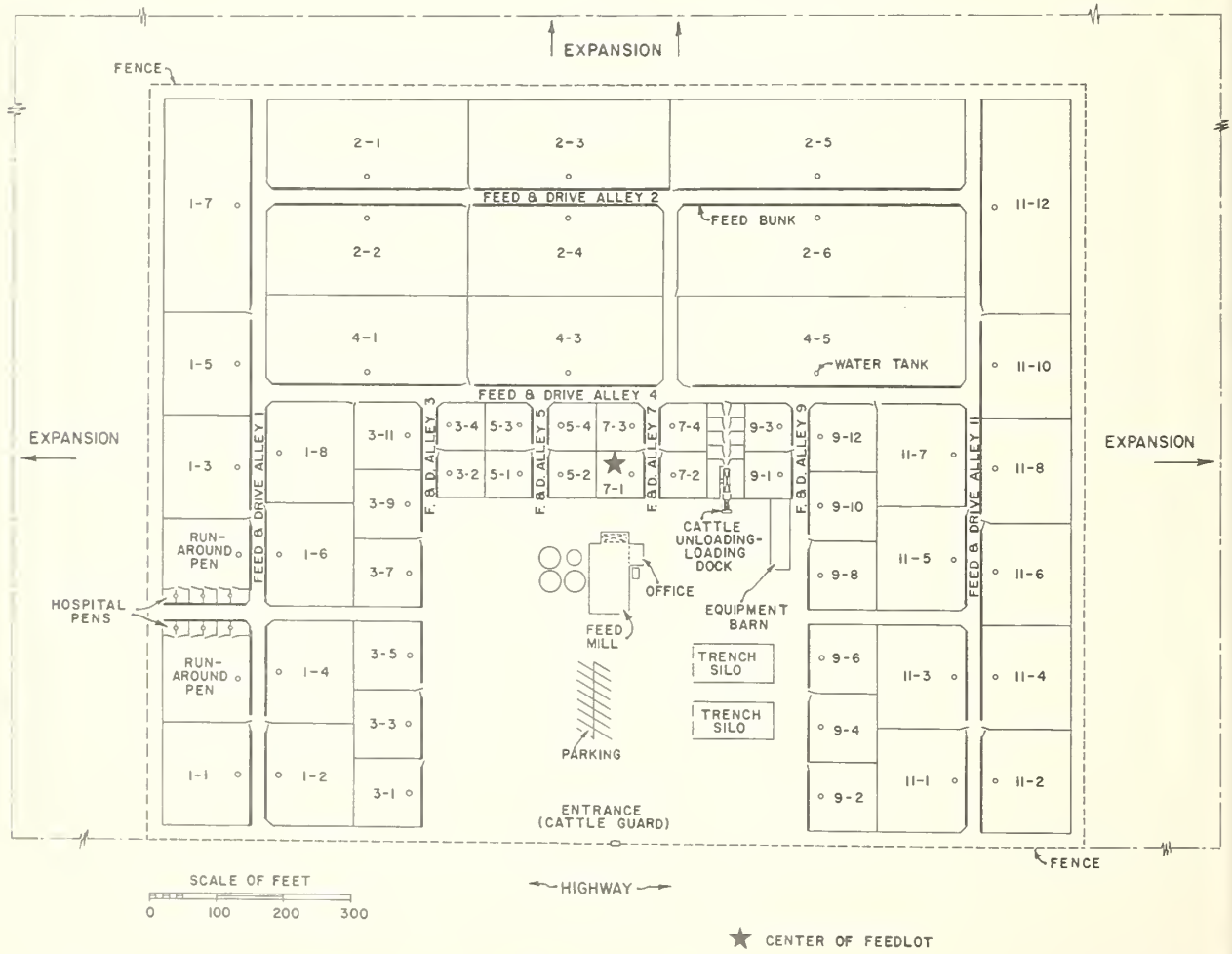


FIGURE 22.—Proposed layout for a commercial cattle feedlot with a capacity for 5,000 head.

cal point of all feedlot activities would remain near the center of the feedlot. In expanding feeding pen facilities small pens would be obtained by dividing pens Nos. 2–4, 4–3, 2–6, and 4–5. The addition of new pens to the rear of the feedlot would require the alley to be extended through pen No. 2–3. Adding pens to the right side of the feedlot would require the present cross alley to be extended through pen No. 11–6.

New hospital and runaround pens in an expansion program would be arranged in the new row of feeding pens added to the left side of the feedlot in the same manner as they are arranged in the present layout. The present facilities for receiving and loading out livestock should be adequate to handle any reasonable increase in the volume. Facilities for receiving and loading out livestock have a low utilization on most feedlots.

Adequate space is provided in the suggested layout for expanding facilities for feeding livestock.

### Amount of Land Needed

The layout for the feedlot with a capacity for 5,000 head shown in figure 22 is 1,385 feet wide and 1,100 feet deep. It contains approximately 35 acres. It is suggested that a feedlot designed to feed 5,000 head of cattle provide at the outset adequate land to permit at least a reasonable expansion. Based on the assumption that the feedlot would eventually double in capacity, a tract of land 1,955 feet wide and 1,385 feet deep would be needed. It would contain approximately 62.2 acres. To obtain the necessary depth and width in some instances may necessitate the buying of more acreage than is needed.

## Layout Designed to Handle 10,000 Head

The major types of facilities needed for a commercial feedlot designed to handle 10,000 head of cattle are the same as those listed for the commercial feedlots designed to handle 1,000 and 5,000 head. The kind and amount of facilities needed and their arrangement differ.

### Facilities Needed

#### Receiving and Loading Out Cattle

A truck dock of the design previously described, a scale and scale platform, a working alley, and 13 catch pens are suggested for receiving and loading out cattle. Ten of the catch pens are 20 feet by 25 feet, 2 pens 25 feet by 40 feet, and one pen 25 feet by 60 feet. Catch pens of these sizes should be adequate for holding several trucklots of cattle belonging to one or more owners. They also should be adequate to permit cattle to be sorted or treated properly.

#### Pens

The type of pen facilities suggested for this layout is the same as those suggested for the other two layouts.

Pens for Feeding Cattle.—Studies of cattle feeding on feedlots with a capacity for 10,000 head show that the typical feedlot feeds the cattle of 39 owners, and that 25 owners use one pen, and 14 owners use 2 pens. In addition, the management maintains 3 trial pens or pens with which he hopes to obtain new business. Thus a total of 56 pens are suggested for the proposed feedlot.

The sizes of lots fed on feedlots of this size ranged from 50 to 500 head. The typical feedlot usually feeds 10 lots of 50 head, 19 lots of 100 head, 13 lots of 200 head, 8 lots of 300 head, 4 lots of 400 head, and 2 lots of 500 head. Thus, pens are suggested for the proposed feedlot for these size lots.

Ten pens 70 feet by 150 feet are suggested for feeding lots of 50 head, 19 pens 130 feet by 150 feet for lots of 100 head, 13 pens 130 feet by 300 feet for lots of 200 head, 8 pens 130 feet by 450 feet for lots of 300 head, 4 pens 130 feet by 600 feet for lots of 400 head, and 2 pens 130 feet by 750 feet for lots of 500 head. The total pen space provided amounts to 1,957,500 square feet.

The feed bunks, the concrete platform extending from the bunks, and the fences for these pens would be of the same design as those suggested for the other two layouts.

Hospital Pens.—Twenty hospital pens 15 feet by 20 feet containing 6,000 square feet are suggested for holding sick and injured animals.

Runaround Pens.—Three runaround pens are suggested. Two pens are 80 feet by 105 feet and one pen is 80 feet by 90 feet. The runaround pens contain 24,000 square feet of space.

#### Alleys

In a feedlot with a capacity for 10,000 head two major types of alleys are suggested—feed alleys and drive alleys. The two alleys are combined on smaller size feedlots. The feed alley should be 20 feet wide and would be used primarily by feed trucks in feeding cattle. Drive alleys should be 12 feet wide and would be used primarily for the movement of cattle into, through, and out of the feedlot. The width of the working alley is 10 feet.

#### Feeding Facilities

For a commercial feedlot with a capacity for 10,000 head the mixing-mill self-unloading truck method (mill capacity 75,000 pounds per hour) of feeding is suggested as the lowest cost method. The components for the mill previously have been described. The building for the mill proper is the same size as the mill proposed for the feedlot with a capacity for 5,000 head. Adjacent to

the building for the mill proper is a building 20 feet by 30 feet. This building would be used as an office by the management. A silage pit 10 feet by 16 feet is located adjacent to the office. The pit should be equipped with a silage drag and have a capacity of about 5 tons.

Storage space for a month's supply of grain and pellets should be provided for the feedlot. Based on feeding 10,000 cattle daily an average of 24 pounds of grain, storage space would be needed for approrimately 125,000 bushels of grain. Thus 5 upright silos 40 feet in diameter and 40 feet high with a storage capacity for about 175,000 bushels are suggested for grain. One upright silo 26 feet in dimaeter and 32 feet high with a storage capacity for approximately 14,000 bushels is suggested for pellets.

Based on feeding 30,000 cattle annually at the rate of 5 pounds of silage per day, storage for 9,000 tons of silage would be needed for the feedlot. Thus 3 trench silos, each 60 feet wide, 145 feet long and 20 feet deep, are suggested for storing silage. The 3 trench silos would provide storage for 9,160 tons of silage.

### Equipment Barn

An equipment barn would be needed for storing two tractors, four dump trucks, three feed trucks, a silage truck, a silage loader, miscellaneous equipment items, and for repairing equipment. Thus an equipment barn 30 feet wide by 150 feet long is suggested for the feedlot.

### Feedlot Fencing

A fence is suggested around all feedlot facilities. The fencing needed amounts to 6,850 feet, and should be located 20 feet from the facilities proper.

### Water Tanks

Each pen should be equipped with an automatic waterer. They would be the same as those suggested for a feedlot with a capacity for 1,000 head.

### Management's Office

Management's office is the same size and provides the same facilities as that described for the 5,000 head feedlot.

### Parking Area

Twenty-four parking spaces, 12 feet wide and 30 feet deep, are suggested for the feedlot. The parking area would be used by employees of the feedlot and feedlot patrons. The number of employees on feedlots with a capacity for 10,000 head range from 14 to 18 people.

### Other Facilities

The other facilities would be similar to those suggested for the feedlot with a capacity for 1,000 head.

## Arrangement of Facilities

The principles involved in the arrangement of the various components for a feedlot with a capacity for 10,000 head are the same as those given for a feedlot with a capacity for 1,000 head or 5,000 head. With minor deviations, the components for this feedlot are arranged similarly.

## Expansion of Facilities

To expand or increase the size of the feedlot, additional feeding pens and feed and drive alleys would be constructed on each side and to the rear of the present pens. In expanding feeding pen facilities small pens would be obtained by dividing pens Nos. 6–13, 4–10, 4–9, 4–1, 4–2, and 6–3. Large pens would be added to the side and rear of the present feeding pens.

New hospital pens and a runaround pen could be obtained by extending the present facilities toward the front of the feedlot. The present facilities for receiving and loading out cattle should be adequate for any reasonable increase in volume.

Adequate space is provided in the suggested layout for expanding facilities for feeding livestock.

## Amount of Land Needed

The layout for the feedlot shown in figure 23 is 1,880 feet wide and 1,551 feet deep. It contains about 66.9 acres. It is suggested that a feedlot designed to handle 10,000 cattle provide adequate land at the outset to permit a reasonable amount of expansion. Based on the assumption that the feedlot would eventually double its capacity, a tract of land 2,470 feet wide and 2,140 feet deep would be needed. The tract would contain 121.3 acres. To obtain the necessary depth and width in some instances may necessitate the buying of more acreage than is needed.

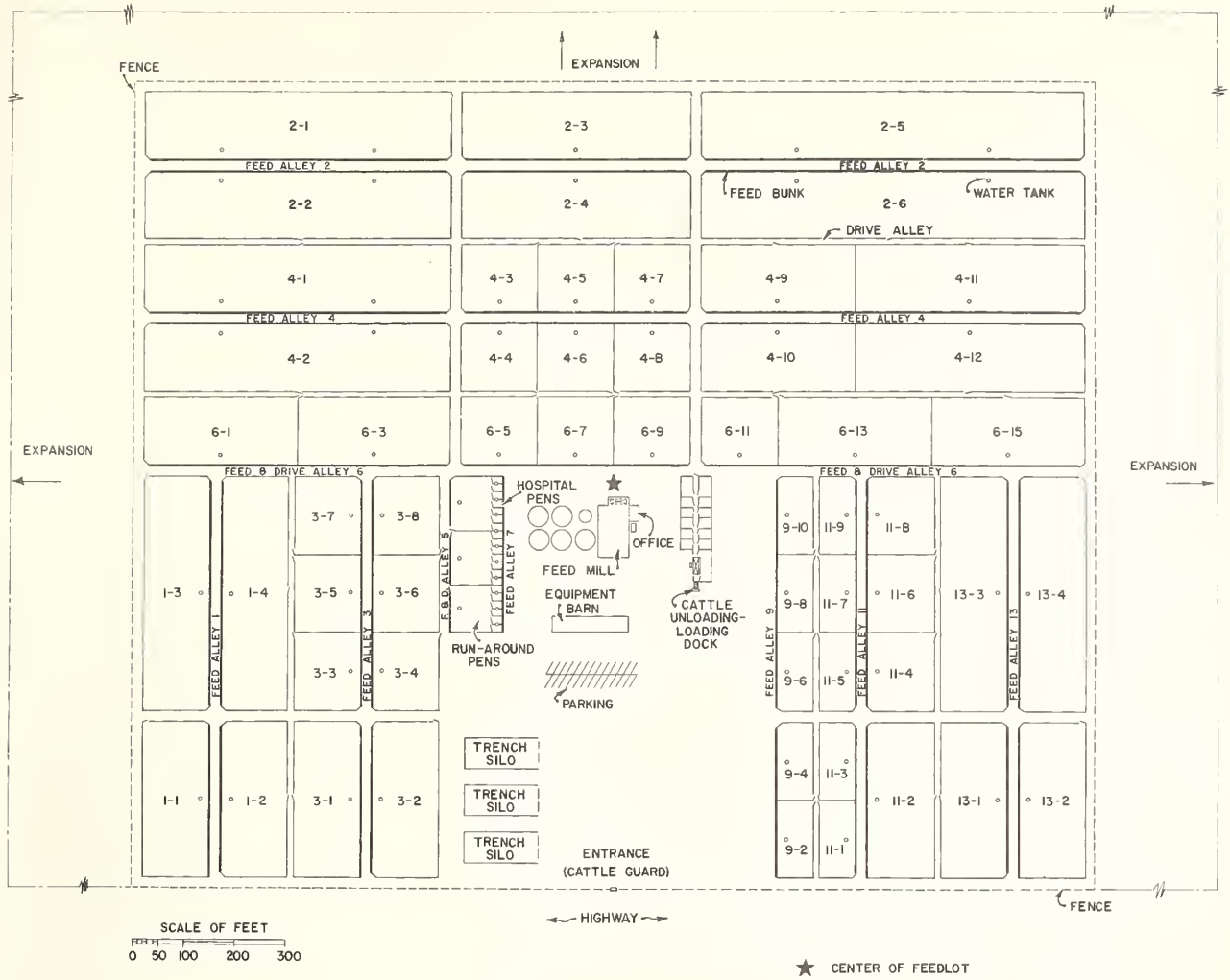


FIGURE 23.—Proposed layout for a commercial cattle feedlot with a capacity for 10,000 head.

# APPENDIX

Three tables have been developed as aids in comparing labor and equipment requirements and costs. Table 14 shows the ownership and operating costs for each item of equipment used. Costs were computed for the typical and proposed layouts for three feedlot sizes. The equipment costs for performing the feeding operation by three methods for the typical and proposed layouts for three feedlot sizes are also shown. Table 15 shows the per-head base and productive times, by method and size of feedlot, for each time item of the feeding operation. Table 16 shows the per-head equipment requirements and costs, by method and size of feedlot, for each item of equipment used in the feeding operation.

TABLE 14.—*Ownership and operating costs for equipment used on commercial cattle feedlots*

| Equipment | Amount of equipment | Size or capacity | Initial cost (f.o.b. factory) | Expected life | Ownership cost | | | | Operating cost | | | Total annual cost | Total annual usage | Cost per hour of use |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Depreciation | Interest (6 percent average investment) | Insurance and taxes (4 percent initial investment) | Total | Fuel and electricity | Maintenance | Total | | | |
| | | | *Dollars* | *Years* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Dollars* | *Hours* | *Dollars* |
| Feedlot with a capacity for 1,000 cattle: | | | | | | | | | | | | | | |
| Receiving and loading out cattle: | | | | | | | | | | | | | | |
| Platform scale [1] | 1 | 10 ft. x 34 ft | 3,000.00 | 15 | 200.00 | 90.00 | 120.00 | 410.00 | | 15.00 | 15.00 | 425.00 | 30 | [2] 14.1666 |
| Feeding cattle: | | | | | | | | | | | | | | |
| Self-mixing self-unloading truck method: | | | | | | | | | | | | | | |
| Grain auger [1] | 1 | 6 inch | 300.00 | 15 | 20.00 | 9.00 | 12.00 | 41.00 | 46.17 | 4.00 | 50.17 | 91.17 | 570 | 0.1599 |
| Pellet auger [1] | 1 | 4 inch | 240.00 | 15 | 16.00 | 7.20 | 9.60 | 32.80 | 12.96 | 1.60 | 14.56 | 47.38 | 240 | .1973 |
| Silage conveyor [1] | 1 | 18 inches wide | 275.00 | 15 | 18.33 | 8.25 | 11.00 | 37.58 | 35.64 | 5.00 | 40.64 | 78.22 | 660 | .1185 |
| Platform scale [3] | 1 | 10 ft. x 34 ft | 3,000.00 | 15 | 200.00 | 90.00 | 120.00 | 410.00 | | 40.00 | 40.00 | 450.00 | 870 | .5172 |
| Platform scale [3] | 1 | 10 ft. x 34 ft | 3,000.00 | 15 | 200.00 | 90.00 | 120.00 | 410.00 | | 34.00 | 34.00 | 444.00 | 690 | .6435 |
| Platform scale [4] | 1 | 10 ft. x 34 ft | 3,000.00 | 15 | 200.00 | 90.00 | 120.00 | 410.00 | | 60.00 | 60.00 | 470.00 | 1,560 | .3013 |
| Silage loader [1] | 1 | 60,000 lb. per hr | 2,995.00 | 15 | 199.67 | 89.85 | 119.80 | 409.32 | 15.00 | 30.00 | 45.00 | 454.32 | 30 | 15.1440 |
| Silage wagon [1] | 1 | 6,000 pounds | 250.00 | 6 | 41.67 | 7.50 | 10.00 | 59.17 | | 15.00 | 15.00 | 74.17 | 780 | .0951 |
| Feed storage barn [1] | 1 | 40 ft. x 40 ft | 6,000.00 | 20 | 300.00 | 180.00 | 240.00 | 720.00 | | 150.00 | 150.00 | 870.00 | | |
| Feed truck [3] | 2 | 6,000 pounds | 13,200.00 | 8 | 1,650.00 | 396.00 | 528.00 | 2,574.00 | 180.00 | 825.00 | 1,005.00 | 3,579.00 | 2,010 | 1.7806 |
| Feed truck [4] | 2 | 6,000 pounds | 13,200.00 | 8 | 1,650.00 | 396.00 | 528.00 | 2,574.00 | 130.00 | 750.00 | 880.00 | 3,454.00 | 1,830 | 1.8874 |
| Mixing-mill and self-unloading truck method (mill capacity 40,000 lb. per hr.): | | | | | | | | | | | | | | |
| Mill [1] | 1 | 40,000 lb. per hr | 85,000.00 | 20 | 4,250.00 | 2,550.00 | 3,400.00 | 10,200.00 | 310.00 | 310.00 | 620.00 | 10,820.00 | 310 | 34.9032 |
| Silage loader [1] | 1 | 60,000 lb. per hr | 2,995.00 | 15 | 199.67 | 89.85 | 119.80 | 409.32 | 15.00 | 30.00 | 45.00 | 454.00 | 30 | 15.1440 |
| Silage truck [3] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 25.00 | 40.00 | 65.00 | 903.50 | 90 | 10.0389 |
| Silage truck [4] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 18.00 | 30.00 | 48.00 | 886.50 | 60 | 14.7550 |
| Feed truck [3] | 2 | 6,000 pounds | 9,600.00 | 8 | 1,200.00 | 288.00 | 384.00 | 1,872.00 | 160.00 | 150.00 | 310.00 | 2,182.00 | 420 | 5.1952 |
| Feed truck [4] | 2 | 6,000 pounds | 9,600.00 | 8 | 1,200.00 | 288.00 | 384.00 | 1,872.00 | 125.00 | 125.00 | 250.00 | 2,122.00 | 360 | 5.8944 |
| Mixing-mill and self-unloading truck method (mill capacity 75,000 lb. per hr.): | | | | | | | | | | | | | | |
| Mill [1] | 1 | 75,000 lb. per hr | 125,000.00 | 20 | 6,250.00 | 3,750.00 | 5,000.00 | 15,000.00 | 270.00 | 225.00 | 495.00 | 15,495.00 | 180 | 86.0833 |
| Silage loader [1] | 1 | 60,000 lb. per hr | 2,995.00 | 15 | 199.67 | 89.85 | 119.80 | 409.32 | 15.00 | 30.00 | 45.00 | 454.00 | 30 | 15.1440 |
| Silage truck [3] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 25.00 | 40.00 | 65.00 | 903.50 | 90 | 10.0389 |
| Silage truck [4] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 18.00 | 30.00 | 48.00 | 886.50 | 60 | 14.7550 |
| Feed truck [3] | 2 | 6,000 pounds | 9,600.00 | 8 | 1,200.00 | 288.00 | 384.00 | 1,872.00 | 160.00 | 150.00 | 310.00 | 2,182.00 | 420 | 5.1952 |
| Feed truck [4] | 2 | 6,000 pounds | 9,600.00 | 8 | 1,200.00 | 288.00 | 384.00 | 1,872.00 | 125.00 | 125.00 | 250.00 | 2,122.00 | 360 | 5.8944 |
| Mounding manure and cleaning pens: | | | | | | | | | | | | | | |
| Tractor [3] | 1 | | 7,400.00 | 10 | 740.00 | 222.00 | 296.00 | 1,258.00 | 180.00 | 150.00 | 330.00 | 1,588.00 | [5] 450 | 3.5289 |
| Tractor [4] | 1 | | 7,400.00 | 10 | 740.00 | 222.00 | 296.00 | 1,258.00 | 180.00 | 140.00 | 320.00 | 1,578.00 | [6] 420 | 3.7571 |
| Tractor [3] | 1 | | 7,400.00 | 10 | 740.00 | 222.00 | 296.00 | 1,258.00 | 150.00 | 140.00 | 290.00 | 1,548.00 | [7] 360 | 4.3000 |
| Tractor [4] | 1 | | 7,400.00 | 10 | 740.00 | 222.00 | 296.00 | 1,258.00 | 150.00 | 130.00 | 280.00 | 1,538.00 | [8] 330 | 4.6606 |
| Dump truck [3] | 1 | 3 cubic yd | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 45.00 | 100.00 | 145.00 | 983.50 | 270 | 3.6426 |
| Dump truck [4] | 1 | 3 cubic yd | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 37.50 | 90.00 | 127.50 | 966.00 | 240 | 4.0250 |
| Feedlot with a capacity for 5,000 cattle: | | | | | | | | | | | | | | |
| Receiving and loading out cattle: | | | | | | | | | | | | | | |
| Platform scale [1] | 1 | 10 ft. x 34 ft | 3,000.00 | 15 | 200.00 | 90.00 | 120.00 | 410.00 | | 75.00 | 75.00 | 485.00 | 150 | [9] 3.2334 |
| Feeding cattle: | | | | | | | | | | | | | | |
| Self-mixing self-unloading truck method: | | | | | | | | | | | | | | |
| Grain auger [1] | 2 | 6 inch | 600.00 | 15 | 40.00 | 18.00 | 24.00 | 82.00 | 230.85 | 20.00 | 250.85 | 332.85 | 2,850 | .1168 |
| Pellet auger [1] | 2 | 4 inch | 480.00 | 15 | 32.00 | 14.40 | 19.20 | 65.60 | 64.80 | 8.00 | 72.80 | 138.40 | 1,200 | .1153 |
| Silage conveyor [1] | 2 | 18 inches wide | 550.00 | 15 | 36.67 | 16.50 | 22.00 | 75.17 | 178.20 | 25.00 | 203.20 | 278.37 | 3,300 | .0844 |
| Platform scale [3] | 2 | 10 ft. x 34 ft | 6,000.00 | 15 | 400.00 | 180.00 | 240.00 | 820.00 | | 200.00 | 200.00 | 1,020.00 | 4,350 | .2345 |
| Platform scale [3] | 2 | 10 ft. x 34 ft | 6,000.00 | 15 | 400.00 | 180.00 | 240.00 | 820.00 | | 170.00 | 170.00 | 990.00 | 3,450 | .2870 |
| Platform scale [4] | 3 | 10 ft. x 34 ft | 9,000.00 | 15 | 600.00 | 270.00 | 360.00 | 1,230.00 | | 300.00 | 300.00 | 1,530.00 | 7,800 | .1962 |
| Silage loader [1] | 1 | 60,000 lb. per hr | 2,995.00 | 15 | 199.67 | 89.85 | 119.80 | 409.32 | 75.00 | 50.00 | 125.00 | 534.32 | 150 | 3.5621 |
| Silage wagon [1] | 2 | 6,000 pounds | 500.00 | 6 | 83.33 | 15.00 | 20.00 | 118.33 | | 50.00 | 50.00 | 168.33 | 3,900 | .0432 |
| Feed storage barn [1] | 1 | 60 ft. x 60 ft | 16,000.00 | 20 | 750.00 | 450.00 | 600.00 | 1,800.00 | | 600.00 | 600.00 | 2,400.00 | | |
| Feed truck [3] | 4 | 6,000 pounds | 26,400.00 | 8 | 3,300.00 | 792.00 | 1,056.00 | 5,148.00 | 900.00 | 2,000.00 | 2,900.00 | 8,048.00 | 9,750 | .8254 |
| Feed truck [4] | 4 | 6,000 pounds | 26,400.00 | 8 | 3,300.00 | 792.00 | 1,056.00 | 5,148.00 | 650.00 | 1,800.00 | 2,450.00 | 7,598.00 | 9,150 | .8304 |
| Mixing-mill and self-unloading truck method: | | | | | | | | | | | | | | |
| Mill [1] | 1 | 40,000 lb. per hr | 85,000.00 | 20 | 4,250.00 | 2,550.00 | 3,440.00 | 10,200.00 | 1,550.00 | 1,550.00 | 3,100.00 | 13,300.00 | 1,550 | 8.5806 |
| Silage loader [1] | 1 | 60,000 lb. per hr | 2,995.00 | 15 | 199.67 | 89.85 | 119.80 | 409.32 | 75.00 | 50.00 | 125.00 | 534.32 | 150 | 3.5621 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Silage truck [3] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 125.00 | 200.00 | 325.00 | 1,163.50 | 450 | 2.5856 |
| Silage truck [4] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 90.00 | 150.00 | 240.00 | 1,078.50 | 300 | 3.5950 |
| Feed truck [3] | 2 | 6,000 pounds | 9,600.00 | 8 | 1,200.00 | 288.00 | 384.00 | 1,872.00 | 825.00 | 480.00 | 1,305.00 | 3,177.00 | 2,100 | 1.5129 |
| Feed truck [4] | 2 | 6,000 pounds | 9,600.00 | 8 | 1,200.00 | 288.00 | 384.00 | 1,872.00 | 575.00 | 375.00 | 950.00 | 2,822.00 | 1,800 | 1.5678 |
| Mixing-mill and self-unloading truck method (mill capacity 75,000 lbs. per hr.): | | | | | | | | | | | | | | |
| Mill [1] | 1 | 75,000 lb. per hr | 125,000.00 | 20 | 6,250.00 | 3,750.00 | 5,000.00 | 15,000.00 | 1,350.00 | 1,125.00 | 2,475.00 | 17,475.00 | 900 | 19.4167 |
| Silage loader [1] | 1 | 60,000 lb. per hr | 2,995.00 | 15 | 199.67 | 89.85 | 119.80 | 409.32 | 75.00 | 50.00 | 125.00 | 534.32 | 150 | 3.5621 |
| Silage truck [3] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 125.00 | 200.00 | 325.00 | 1,163.50 | 450 | 2.5856 |
| Silage truck [4] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 90.00 | 150.00 | 240.00 | 1,078.50 | 300 | 3.5950 |
| Feed truck [3] | 2 | 6,000 pounds | 9,600.00 | 8 | 1,200.00 | 288.00 | 384.00 | 1,872.00 | 825.00 | 480.00 | 1,305.00 | 3,177.00 | 2,100 | 1.5129 |
| Feed truck [4] | 2 | 6,000 pounds | 9,600.00 | 8 | 1,200.00 | 288.00 | 384.00 | 1,872.00 | 575.00 | 375.00 | 950.00 | 2,822.00 | 1,800 | 1.5678 |
| Mounding manure and cleaning pens: | | | | | | | | | | | | | | |
| Tractor [3] | 1 | | 7,400.00 | 10 | 740.00 | 222.00 | 296.00 | 1,258.00 | 900.00 | 600.00 | 1,500.00 | 2,758.00 | [10] 1,800 | 1.5322 |
| Tractor [4] | 1 | | 7,400.00 | 10 | 740.00 | 222.00 | 296.00 | 1,258.00 | 900.00 | 600.00 | 1,500.00 | 2,758.00 | [10] 1,800 | 1.5322 |
| Tractor [3] | 1 | | 7,400.00 | 10 | 740.00 | 222.00 | 296.00 | 1,258.00 | 750.00 | 500.00 | 1,250.00 | 2,508.00 | [11] 1,350 | 1.8578 |
| Tractor [4] | 1 | | 7,400.00 | 10 | 740.00 | 222.00 | 296.00 | 1,258.00 | 750.00 | 500.00 | 1,250.00 | 2,508.00 | [11] 1,350 | 1.8578 |
| Dump truck [3] | 2 | 3 cubic yards | 8,600.00 | 8 | 1,075.00 | 258.00 | 344.00 | 1,677.00 | 350.00 | 650.00 | 1,000.00 | 2,677.00 | 1,800 | 1.4872 |
| Dump truck [4] | 2 | 3 cubic yards | 8,600.00 | 8 | 1,075.00 | 258.00 | 344.00 | 1,677.00 | 250.00 | 650.00 | 900.00 | 2,577.00 | 1,800 | 1.4317 |
| Feedlots with a capacity for 10,000 cattle: | | | | | | | | | | | | | | |
| Receiving and loading out cattle: | | | | | | | | | | | | | | |
| Platform scale [1] | 1 | 10 ft. x 34 ft | 3,000.00 | 15 | 200.00 | 90.00 | 120.00 | 410.00 | | 150.00 | 150.00 | 560.00 | 300 | [12] 1.8666 |
| Feeding cattle: | | | | | | | | | | | | | | |
| Self-mixing self-unloading truck method: | | | | | | | | | | | | | | |
| Grain auger [1] | 4 | 6 inch | 1,200.00 | 15 | 80.00 | 36.00 | 48.00 | 164.00 | 461.70 | 40.00 | 501.70 | 565.70 | 5,700 | .0992 |
| Pellet auger [1] | 4 | 4 inch | 960.00 | 15 | 64.00 | 28.80 | 38.40 | 131.20 | 129.60 | 16.00 | 145.60 | 276.80 | 2,400 | .1153 |
| Silage conveyor [1] | 4 | 18" wide | 1,100.00 | 15 | 73.34 | 33.00 | 44.00 | 150.34 | 356.40 | 50.00 | 406.40 | 556.74 | 6,600 | .0844 |
| Platform scale [3] | 4 | 10 ft. x 34 ft | 12,000.00 | 15 | 800.00 | 360.00 | 480.00 | 1,640.00 | | 400.00 | 400.00 | 2,040.00 | 8,700 | .2345 |
| Platform scale [3] | 4 | 10 ft. x 34 ft | 12,000.00 | 15 | 800.00 | 360.00 | 480.00 | 1,640.00 | | 340.00 | 340.00 | 1,980.00 | 6,900 | .2870 |
| Platform scale [4] | 6 | 10 ft. x 34 ft | 18,000.00 | 15 | 1,200.00 | 540.00 | 720.00 | 2,460.00 | | 600.00 | 600.00 | 3,060.00 | 15,600 | .1962 |
| Silage loader [1] | 1 | 60,000 lb. per hr | 2,995.00 | 15 | 199.67 | 89.95 | 119.80 | 409.32 | 150.00 | 100.00 | 250.00 | 659.32 | 300 | 2.1977 |
| Silage wagon [1] | 4 | 6,000 pounds | 1,000.00 | 6 | 166.67 | 30.00 | 40.00 | 236.67 | | 100.00 | 100.00 | 336.67 | 7,800 | .0432 |
| Feed storage barn [1] | 1 | 75 ft. x 75 ft | 22,000.00 | 20 | 1,100.00 | 660.00 | 880.00 | 2,640.00 | | 800.00 | 800.00 | 3,440.00 | | |
| Feed truck [3] | 8 | 12,000 pound | 57,600.00 | 8 | 7,200.00 | 1,728.00 | 2,304.00 | 11,232.00 | 1,440.00 | 3,600.00 | 5,040.00 | 16,272.00 | 19,200 | .8475 |
| Feed truck [4] | 8 | 12,000 pound | 57,600.00 | 8 | 7,200.00 | 1,728.00 | 2,304.00 | 11,232.00 | 900.00 | 3,200.00 | 4,100.00 | 15,332.00 | 18,300 | .8378 |
| Mill mixing self-unloading truck method (mill capacity 40,000 lb. per hr.): | | | | | | | | | | | | | | |
| Mill [1] | 1 | 40,000 lb. per hr | 85,000.00 | 20 | 4,250.00 | 2,550.00 | 3,400.00 | 10,200.00 | 3,100.00 | 3,100.00 | 6,200.00 | 16,400.00 | 3,100 | 5.2903 |
| Silage loader [1] | 1 | 60,000 lb. per hr | 2,995.00 | 15 | 199.67 | 89.85 | 119.80 | 409.32 | 150.00 | 100.00 | 250.00 | 659.32 | 300 | 2.1977 |
| Silage truck [3] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 250.00 | 350.00 | 600.00 | 1,438.50 | 900 | 1.5983 |
| Silage truck [4] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 180.00 | 275.00 | 455.00 | 1,293.50 | 600 | 2.1558 |
| Feed truck [3] | 3 | 12,000 pounds | 16,200.00 | 8 | 2,025.00 | 486.00 | 648.00 | 3,159.00 | 1,400.00 | 1,200.00 | 2,600.00 | 5,759.00 | 4,200 | 1.3712 |
| Feed truck [4] | 3 | 12,000 pounds | 16,200.00 | 8 | 2,025.00 | 486.00 | 648.00 | 3,159.00 | 950.00 | 1,000.00 | 1,950.00 | 5,109.00 | 3,600 | 1.4192 |
| Upright silo [1] | 2 | 32 ft diameter | 17,500.00 | 20 | 875.00 | 525.00 | 700.00 | 2,100.00 | | 450.00 | 450.00 | 2,550.00 | | |
| Mill-mixing self-unloading truck method (mill capacity 75,000 lb. per hr.) | | | | | | | | | | | | | | |
| Mill [1] | 1 | 75,000 lb. per hr | 125,000.00 | 20 | 6,250.00 | 3,750.00 | 5,000.00 | 15,000.00 | 2,700.00 | 2,250.00 | 4,950.00 | 19,950.00 | 1,800 | 11.0833 |
| Silage loader [1] | 1 | 60,000 lb. per hr | 2,995.00 | 15 | 199.67 | 89.85 | 119.80 | 409.32 | 150.00 | 100.00 | 250.00 | 659.32 | 300 | 2.1977 |
| Silage truck [3] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 250.00 | 350.00 | 600.00 | 1,438.50 | 900 | 1.5983 |
| Silage truck [4] | 1 | 10,000 pounds | 4,300.00 | 8 | 537.50 | 129.00 | 172.00 | 838.50 | 180.00 | 275.00 | 455.00 | 1,293.50 | 600 | 2.1558 |
| Feed truck [3] | 3 | 12,000 pounds | 16,200.00 | 8 | 2,025.00 | 486.00 | 648.00 | 3,159.00 | 1,400.00 | 1,200.00 | 2,600.00 | 5,759.00 | 4,200 | 1.3712 |
| Feed truck [4] | 3 | 12,000 pounds | 16,200.00 | 8 | 2,025.00 | 486.00 | 648.00 | 3,159.00 | 950.00 | 1,000.00 | 1,950.00 | 5,109.00 | 3,600 | 1.4192 |
| Mounding manure and cleaning pens: | | | | | | | | | | | | | | |
| Tractor [3] | 2 | | 14,800.00 | 10 | 1,480.00 | 444.00 | 592.00 | 2,516.00 | 1,800.00 | 1,200.00 | 3,000.00 | 5,516.00 | [13] 3,900 | 1.4144 |
| Tractor [4] | 2 | | 14,800.00 | 10 | 1,480.00 | 444.00 | 592.00 | 2,516.00 | 1,800.00 | 1,125.00 | 2,925.00 | 5,441.00 | [14] 3,600 | 1.5114 |
| Tractor [3] | 2 | | 14,800.00 | 10 | 1,480.00 | 444.00 | 592.00 | 2,516.00 | 1,500.00 | 1,000.00 | 2,500.00 | 5,016.00 | [15] 3,000 | 1.6720 |
| Tractor [4] | 2 | | 14,800.00 | 10 | 1,480.00 | 444.00 | 592.00 | 2,516.00 | 1,500.00 | 950.00 | 2,450.00 | 4,966.00 | [16] 2,700 | 1.8393 |
| Dump truck [3] | 4 | 3 cubic yards | 17,200.00 | 8 | 2,150.00 | 516.00 | 688.00 | 3,364.00 | 800.00 | 1,500.00 | 2,300.00 | 5,664.00 | 3,900 | 1.4523 |
| Dump truck [4] | 4 | 3 cubic yards | 17,200.00 | 8 | 2,150.00 | 516.00 | 688.00 | 3,364.00 | 500.00 | 1,250.00 | 1,750.00 | 5,114.00 | 3,600 | 1.4205 |

[1] Item used with typical and improved layouts.
[2] Cost allocation by operation: $7.0833 for receiving and $7.0833 for loading out.
[3] Item used with typical layout.
[4] Item used with improved layout.
[5] Allocation by operations: Towing silage wagon, 90 hours; mounding manure, 90 hours; and cleaning pens, 270 hours.
[6] Allocation by operations: Towing silage wagon, 90 bours; mounding manure, 90 hours; and cleaning pens, 240 hours.
[7] Allocation hy operations: Mounding manure, 90 bours; and cleaning pens, 270 hours.
[8] Allocation by operations: Mounding manure, 90 hours; and cleaning pens, 240 hours.
[9] Cost allocation by operations: $1.6167 for receiving and $1.6167 for loading out.
[10] Allocation by operations: Towing silage wagon, 450 hours; mounding manure, 450 hours; and cleaning pens, 900 hours.
[11] Allocation by operations: Mounding manure, 450 hours; and cleaning pens, 900 hours.
[12] Cost allocation by operations: $0.9333 for receiving and $0.9333 for loading out.
[13] Allocation hy operations: Towing silage wagon, 900 hours; mounding manure, 900 hours; and cleaning pens, 2,100 hours.
[14] Allocation by operations: Towing silage wagon, 900 hours; mounding manure, 900 hours; and cleaning pens, 1,800 hours.
[15] Allocation hy operations: Mounding manure, 900 hours; and cleaning pens, 2,100 hours.
[16] Allocation hy operations: Mounding manure, 900 hours; and cleaning pens, 1,800 hours.

TABLE 15.—*Productive labor requirements per head for feeding cattle, by size of feedlot and method, layout, and time item*

| Method, layout, and time item | Labor requirements by feedlot sizes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1,000-head capacity feedlot | | | 5,000-head capacity feedlot | | | 10,000-head capacity feedlot | | |
| | Base time | Fatigue and personal allowance | Productive time | Base time | Fatigue and personal allowance | Productive time | Base time | Fatigue and personal allowance | Productive time |
| | *Man-hours* | *Percent* | *Man-hours* | *Man-hours* | *Percent* | *Man-hours* | *Man-hours* | *Percent* | *Man-hours* |
| Self-mixing self-unloading feed truck method: | | | | | | | | | |
| Typical layout: | | | | | | | | | |
| Auger grain and pellets onto truck | 0. 26 | 10 | 0. 29 | 0. 26 | 10 | 0. 29 | 0. 26 | 10 | 0. 29 |
| Drive truck to silage loading station (average distance 200 feet) | . 04 | 10 | . 04 | . 02 | 10 | . 02 | . 01 | 10 | . 01 |
| Load silage onto truck | . 20 | 15 | . 23 | . 20 | 15 | . 23 | . 20 | 15 | . 23 |
| Transport silage to silage loading station [1] | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Drive loaded truck to feed bunk [2] | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Auger feed into feed bunk | . 05 | 10 | . 05 | . 05 | 10 | . 05 | . 05 | 10 | . 05 |
| Drive empty truck to feed barn [2] | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Total | 0. 64 | | 0. 70 | 0. 62 | | 0. 68 | 0. 61 | | 0. 67 |
| Improved layout: | | | | | | | | | |
| Auger grain and pellets onto trucks | 0. 26 | 10 | 0. 29 | 0. 26 | 10 | 0. 29 | 0. 26 | 10 | 0. 29 |
| Load silage onto truck | . 20 | 15 | . 23 | . 20 | 15 | . 23 | . 20 | 15 | . 23 |
| Transport silage to silage loading station [1] | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Drive loaded truck to feed bunk [3] | . 02 | 10 | . 02 | . 02 | 10 | . 02 | . 02 | 10 | . 02 |
| Auger feed into feed bunk | . 05 | 10 | . 05 | . 05 | 10 | . 05 | . 05 | 10 | . 05 |
| Drive empty truck to feed barn [3] | . 02 | 10 | . 02 | . 02 | 10 | . 02 | . 02 | 10 | . 02 |
| Total | 0. 58 | | 0. 64 | 0. 58 | | 0. 64 | 0. 58 | | 0. 64 |
| Mixing-mill and self-unloading truck method (mill capacity 40,000 lb. per hour): | | | | | | | | | |
| Typical layout: | | | | | | | | | |
| Mix feed | 0. 18 | 10 | 0. 20 | 0. 18 | 10 | 0. 20 | 0. 18 | 10 | 0. 20 |
| Load feed onto truck | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Transport silage to silage pit | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Drive loaded truck to feed bunk | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Auger feed into feed bunk | . 05 | 10 | . 05 | . 05 | 10 | . 05 | . 05 | 10 | . 05 |
| Drive empty truck to mill | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Total | 0. 35 | | 0. 37 | 0. 35 | | 0. 37 | 0. 35 | | 0. 37 |
| Improved layout: | | | | | | | | | |
| Mix feed | 0. 18 | 10 | 0. 20 | 0. 18 | 10 | 0. 20 | 0. 18 | 10 | 0. 20 |
| Load feed onto truck | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Transport silage to silage pit | . 02 | 10 | . 02 | . 02 | 10 | . 02 | . 02 | 10 | . 02 |
| Drive loaded truck to feed bunk | . 02 | 10 | . 02 | . 02 | 10 | . 02 | . 02 | 10 | . 02 |
| Auger feed into feed bunk | . 05 | 10 | . 05 | . 05 | 10 | . 05 | . 05 | 10 | . 05 |
| Drive empty truck to mill | . 02 | 10 | . 02 | . 02 | 10 | . 02 | . 02 | 10 | . 02 |
| Total | 0. 32 | | 0. 34 | 0. 32 | | 0. 34 | 0. 32 | | 0. 34 |
| Mixing-mill and self-unloading truck method (mill capacity 75,000 lb. per hour): | | | | | | | | | |
| Typical layout: | | | | | | | | | |
| Mix feed | 0. 11 | 10 | 0. 12 | 0. 11 | 10 | 0. 12 | 0. 11 | 10 | 0. 12 |
| Load feed onto truck | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Transport silage to silage pit | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Drive loaded truck to feed bunk | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Auger feed into feed bunk | . 05 | 10 | . 05 | . 05 | 10 | . 05 | . 05 | 10 | . 05 |
| Drive empty truck to mill | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Total | 0. 28 | | 0. 29 | 0. 28 | | 0. 29 | 0. 28 | | 0. 29 |

See footnote at end of table.

TABLE 15.—*Productive labor requirements per head for feeding cattle, by size of feedlot and method, layout, and time item*—Continued

| Method, layout, and time item | Labor requirements by feedlot sizes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1,000-head capacity feedlot | | | 5,000-head capacity feedlot | | | 10,000-head capacity feedlot | | |
| | Base time | Fatigue and personal allowance | Productive time | Base time | Fatigue and personal allowance | Productive time | Base time | Fatigue and personal allowance | Productive time |
| Mixing-mill and self-unloading truck method (mill capacity 75,000 lb. per hour)—Con. | *Man-hours* | | *Man-hours* | *Man-hours* | | *Man-hours* | *Man-hours* | | *Man-hours* |
| Improved layout: | | *Percent* | | | *Percent* | | | *Percent* | |
| Mix feed | 0. 11 | 10 | 0. 12 | 0. 11 | 10 | 0. 12 | 0. 11 | 10 | 0. 12 |
| Load feed onto truck | . 03 | 10 | . 03 | . 03 | 10 | . 03 | . 03 | 10 | . 03 |
| Transport silage to silage pit | . 02 | 10 | . 02 | . 02 | 10 | . 02 | . 02 | 10 | . 02 |
| Drive loaded truck to feed bunk | . 02 | 10 | . 02 | . 02 | 10 | . 02 | . 02 | 10 | . 02 |
| Auger feed into feed bunk | . 05 | 10 | . 05 | . 05 | 10 | . 05 | . 05 | 10 | . 05 |
| Drive empty truck to mill | . 02 | 10 | . 02 | . 02 | 10 | . 02 | . 02 | 10 | . 02 |
| Total | 0. 25 | | 0. 26 | 0. 25 | | 0. 26 | 0. 25 | | 0. 26 |

[1] Average transport distances by size of feedlot: 1,000-head capacity—200 feet; 5,000-head capacity—300 feet; and 10,000-head capacity—400 feet.

[2] Average transport distances by size of feedlot: 1,000-head capacity—400 feet; 5,000-head capacity—900 feet; and 10,000-head capacity—1,500 feet.

[3] Average transport distances by size of feedlot: 1,000-head capacity—325 feet; 5,000-head capacity—600 feet; and 10,000-head capacity—850 feet.

TABLE 16.—*Equipment requirements and cost per head for feeding cattle*

| Method, layout, and item of equipment | Equipment requirements by feedlot sizes | | | | | |
|---|---|---|---|---|---|---|
| | 1,000-head capacity feedlot | | 5,000-head capacity feedlot | | 10,000-head capacity feedlot | |
| | *Machine-hours* | *Dollars* | *Machine-hours* | *Dollars* | *Machine-hours* | *Dollars* |
| Self-mixing self-unloading feed truck method: | | | | | | |
| Typical layout: | | | | | | |
| Grain auger | 0. 19 | 0. 03 | 0. 19 | 0. 02 | 0. 19 | 0. 02 |
| Pellet auger | . 08 | . 02 | . 08 | . 01 | . 08 | . 01 |
| Silage conveyor | . 22 | . 03 | . 22 | . 02 | . 22 | . 02 |
| Platform scale (feed barn) | . 29 | . 15 | . 29 | . 07 | . 29 | . 07 |
| Platform scale (silage station) | . 23 | . 15 | . 23 | . 07 | . 23 | . 07 |
| Silage loader | . 01 | . 15 | . 01 | . 04 | . 01 | . 02 |
| Silage wagon | . 26 | . 02 | . 26 | . 01 | . 26 | . 01 |
| Feed storage barn | ---------- | . 29 | ---------- | . 16 | ---------- | . 11 |
| Feed truck | . 67 | 1. 19 | . 65 | . 54 | . 64 | . 54 |
| Tractor | . 03 | . 11 | . 03 | . 05 | . 03 | . 05 |
| Total | 1. 98 | 2. 14 | 1. 96 | 0. 99 | 1. 95 | 0. 92 |
| Improved layout: | | | | | | |
| Grain auger | 0. 19 | 0. 03 | 0. 19 | 0. 02 | 0. 19 | 0. 02 |
| Pellet auger | . 08 | . 02 | . 08 | . 01 | . 08 | . 01 |
| Silage conveyor | . 22 | . 03 | . 22 | . 02 | . 22 | . 02 |
| Platform scale (feed barn) | . 52 | . 16 | . 52 | . 10 | . 52 | . 10 |
| Silage loader | . 01 | . 15 | . 01 | . 04 | . 01 | . 02 |
| Silage wagon | . 26 | . 02 | . 26 | . 01 | . 26 | . 01 |
| Feed storage barn | ---------- | . 29 | ---------- | . 16 | ---------- | . 11 |
| Feed truck | . 61 | 1. 15 | . 61 | . 51 | . 61 | . 51 |
| Tractor | . 02 | . 08 | . 02 | . 03 | . 02 | . 03 |
| Total | 1. 91 | 1. 93 | 1. 91 | 0. 90 | 1. 91 | 0. 83 |
| Mixing mill and self-unloading truck method (mill capacity 40,000 pounds per hour): | | | | | | |
| Typical layout: | | | | | | |
| Mill | 0. 10 | 3. 49 | 0. 10 | 0. 86 | 0. 10 | 0. 53 |
| Silage loader | . 01 | . 15 | . 01 | . 04 | . 01 | . 02 |
| Silage truck | . 03 | . 30 | . 03 | . 08 | . 03 | . 05 |
| Feed truck | . 14 | . 73 | . 14 | . 21 | . 14 | . 19 |
| Upright silo | ---------- | ---------- | ---------- | ---------- | ---------- | . 09 |
| Total | 0. 28 | 4. 67 | 0. 28 | 1. 19 | 0. 28 | 0. 88 |
| Improved layout: | | | | | | |
| Mill | 0. 10 | 3. 49 | 0. 10 | 0. 86 | 0. 10 | 0. 53 |
| Silage loader | . 01 | . 15 | . 01 | . 04 | . 01 | . 02 |
| Silage truck | . 02 | . 29 | . 02 | . 07 | . 02 | . 04 |
| Feed truck | . 12 | . 71 | . 12 | . 19 | . 12 | . 17 |
| Upright silo | ---------- | ---------- | ---------- | ---------- | ---------- | . 09 |
| Total | 0. 25 | 4. 64 | 0. 25 | 1. 16 | 0. 25 | 0. 85 |
| Mixing mill and self-unloading truck method (mill capacity 75,000 pounds per hour): | | | | | | |
| Typical layout: | | | | | | |
| Mill | 0. 06 | 5. 17 | 0. 06 | 1. 16 | 0. 06 | 0. 66 |
| Silage loader | . 01 | . 15 | . 01 | . 04 | . 01 | . 02 |
| Silage truck | . 03 | . 30 | . 03 | . 08 | . 03 | . 05 |
| Feed truck | . 14 | . 73 | . 14 | . 21 | . 14 | . 19 |
| Total | 0. 24 | 6. 35 | 0. 24 | 1. 49 | 0. 24 | 0. 92 |
| Improved layout: | | | | | | |
| Mill | 0. 06 | 5. 17 | 0. 06 | 1. 16 | 0. 06 | 0. 66 |
| Silage loader | . 01 | . 15 | . 01 | . 04 | . 01 | . 02 |
| Silage truck | . 02 | . 29 | . 02 | . 07 | . 02 | . 04 |
| Feed truck | . 12 | . 71 | . 12 | . 19 | . 12 | . 17 |
| Total | 0. 21 | 6. 32 | 0. 21 | 1. 46 | 0. 21 | 0. 89 |

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